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Includes aeronautics (general), aerodynamics, air transportation and safety, aircraft communications and navigation, aircraft design, testing and performance, aircraft instrumentation, aircraft propulsion and power, aircraft stability and control, and research and support facilities (air).

For related information see also *Astronautics*.

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For related information see also *34 Fluid Mechanics and Heat Transfer*.

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Includes aircraft simulation technology.

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Includes cockpit and cabin display devices; and flight instruments.

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For related information see also *14 Ground Support Systems and Facilities (Space)*.

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For related information see also *Aeronautics*.

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82 DOCUMENTATION AND INFORMATION SCIENCE 2931
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software.*

83 ECONOMICS AND COST ANALYSIS N.A.
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE 2931
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 2931
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences.*

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 2933
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 2934
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 2935
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

92 SOLAR PHYSICS 2935
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 2936
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

GENERAL

99 GENERAL 2936

Note: N.A. means that no abstracts were assigned to this category for this issue.

SUBJECT INDEX I-1
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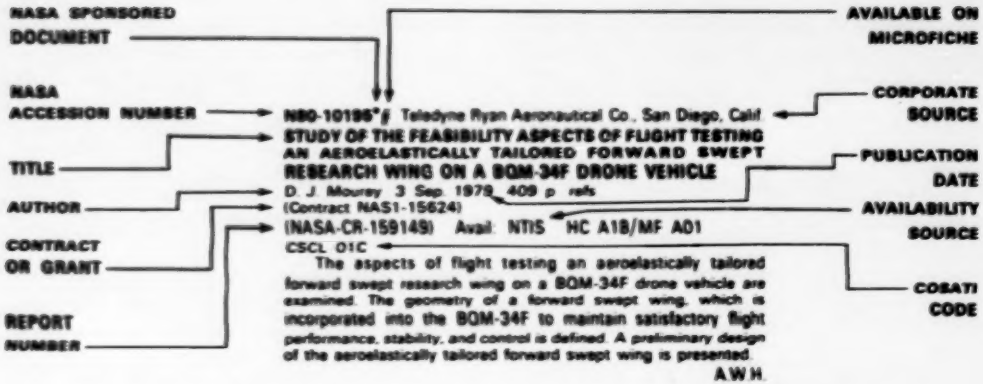
CONTRACT NUMBER INDEX I-89
REPORT/ACCESSION NUMBER INDEX I-93

TYPICAL CITATION AND ABSTRACT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TITLE
STUDY OF THE FEASIBILITY ASPECTS OF FLIGHT TESTING AN AEROELASTICALLY TAILORED FORWARD SWEPT RESEARCH WING ON A BQM-34F DRONE VEHICLE
PUBLICATION DATE
AUTHOR
D. J. Mourey 3 Sep. 1979 409 p refs
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The aspects of flight testing an aeroelastically tailored forward swept research wing on a BQM-34F drone vehicle are examined. The geometry of a forward swept wing, which is incorporated into the BQM-34F to maintain satisfactory flight performance, stability, and control is defined. A preliminary design of the aeroelastically tailored forward swept wing is presented.
A.W.H.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, NON-PERSONAL, QUICK REACTION, ENGINEERING AND TECHNICAL SERVICES

S.V. Bourgeois, Lockheed Missiles & Space Co. Inc., *4800 Bradford Dr., Huntsville, Alabama* 35807 (68-02-2614; F610A-790450)

OBJECTIVE: Provide technical support.

PROGRESS: D. Richard Sears, Air Pollutant Emission Factors for Military and Civil Aircraft. PB-292 520/4BE EPA/450/3-78/117 Oct. 78. Using data supplied by the U.S. Navy, U.S. Air Force, USEPA Office of Mobile Source Air Pollution Control as well as published information, tables of military aircraft fuel characteristics, aircraft classifications, military and civil times in mode, engine, modal emission rates, and aircraft emission factors per landing/takeoff cycle are calculated and combined.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Industrial Environmental Research Lab.

1.0002, NASA/LEWIS RESEARCH CENTER COMPUTATIONAL STRUCTURES APPRENTICESHIPS

R.H. Gallagher, University of Arizona, School of Engineering, Dept. of Civil Engineering & Engineering Mechanics, *Tucson, Arizona 85721 (NAG 3-45)*

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0003, FUNDAMENTAL CHARACTERISTICS OF SPANWISE BLOWING

T. Dansby, Lockheed Georgia Co., *86 S. Cobb Dr., Marietta, Georgia 30060 (DN890157; N00019-79-C-0103)*

Increasing the lift capability of a finite wing by spanwise blowing has been under active consideration since 1968. However, most of the investigations have been concerned with exploring applications with the concept, rather than oriented toward gain of an understanding of the fundamental relationship involved. As a result, it has not been possible to extrapolate the results obtained in one application to a different application. The objective of this work is to determine the fundamental relationships governing the behavior and effectivity of spanwise blowing.

A series of wind tunnel test will be conducted on a floor-mounted semi-span model. Test parameters will include variations in lifting surface geometry such as incidence, sweep and section shape, and variations in nozzle parameters such as nozzle diameter, pressure ratio, location and orientation. Detailed flow visualization, surface pressure and force data will be obtained. These data, along with existing data, will be analyzed and correlations performed in order to produce a unified theory of spanwise blowing.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0004, SPIN SCAN GLOBAL AUREOLA IMAGING INSTRUMENT EXPERIMENT FOR DYNAMICS EXPLORER PHASE III

L.A. Frank, University of Iowa, School of Liberal Arts, Dept. of Physics & Astronomy, *Jessup Hall, Iowa City, Iowa* 52240 (NAS 5-25689)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

1.0005, PROPELLER PROPULSION INTEGRATION PHASE II

A.G. Bennett, Mississippi State University, School of Engineering, Dept. of Aerophysics & Aerospace Engineering, *Suite 101 Engineering Bldg., Mississippi State, Mississippi* 39762 (NAG 3-56)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0006, THE FEASIBILITY OF PERFORMING IN-FLIGHT MEASUREMENTS OF AIR FLOW TRANSITION AND BOUNDARY LAYERS USING A HOT WIRE ANEMOMETRY SYSTEM

G. Kousourou, City University of New York, Queensborough Community College, Undergraduate School, Dept. of Electrical Technology, *56th & Springfield Aves., Bayside, New York* 11364 (NAG 4-2)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Hugh L. Dryden Flight Research Center

1.0007, EFFECTS OF ICE FORMATION ON 2-D AERODYNAMIC SHAPES

G.M. Gregorek, Ohio State University, Columbus Campus, School of Engineering, Dept. of Aeronautics & Astronautics, *190 N. Oval Dr., Columbus, Ohio* 43210 (NAG 3-28)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0008, NASA LERC/AKRON UNIVERSITY GRADUATE COOPERATIVE FELLOWSHIP PROGRAMS

A.L. Simon, University of Akron, School of Engineering, Dept. of Civil Engineering, *302 E. Buchtel Ave., Akron, Ohio* 44304 (NAG 3-50)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0009, ANALYTICAL STUDY OF THE COMPRESSIBLE THREE-DIMENSIONAL FLOW IN TURBINE SCROLLS

A.A. Hamed, University of Cincinnati, School of Engineering, Dept. of Aerospace Engineering, *101 Baldwin Hall, Cincinnati, Ohio* 45221 (NAG 3-52)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0010, EXPERIMENTAL STUDY OF RADIAL TURBINE SCROLLS

W. Tabakoff, University of Cincinnati, School of Engineering, Dept. of Aerospace Engineering, *101 Baldwin Hall, Cincinnati, Ohio* 45221 (NAG 3-26)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0011, GUST RESPONSE OF WIDE-BODIED JET AIRCRAFT INCLUDING AUTOPILOT STUDIES

J.H. Goldberg, Villanova University, School of Engineering, Dept. of Mechanical Engineering, *Villanova, Pennsylvania* 19085 (NAS 1-16095)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0012, AIRFRAME/PROPELLER PROPULSION INTEGRATION ANALYSES

S.J. Miley, Texas A & M University, College Station Campus, School of Engineering, Dept. of Aerospace Engineering, *P.O. Box F E 44, College Station, Texas* 77843 (NAG 2-25)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, THE APPLICATION OF PROBABILISTIC DESIGN THEORY TO HIGH TEMPERATURE LOW CYCLE FATIGUE

P.H. Wirsching, University of Arizona, School of Engineering, Dept. of Aerospace & Mechanical Engineering, *Tucson, Arizona* 85721 (NAG 3-41)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0002, MOLECULAR COMPLEXES PRODUCED IN LAYERED TRANSITION ELEMENT DICHALCOGENIDES BY INTERCALATION OF ADDUCTS

J.V. Acrivos, California State University & Colleges, San Jose State University, School of Science, Dept. of Chemistry, *Washington Sq., San Jose, California* 95192 (DMR77-09033)

The dynamics of intercalating donor adducts in between the layers of transition element dichalcogenides is being investigated in order to obtain a relationship between chemical composition and the bulk electromagnetic properties of the solid. The experimental program utilizes nuclear magnetic resonance, X-ray, and thermophysical methods. It is dedicated to characterizing how cooperative phenomena and the lattice instabilities in systems of lower dimensionality affect the chemical reactivity of gases adsorbed on the basal planes and/or inserted in between the metallic or semimetallic layers of transition element dichalcogenides.

The purpose of the work is to determine the variables controlling the physicochemical properties in systems of lower dimensionality so that new materials may be designed.

This is a continuation of research supported under DMR74-11752.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0003, MOLECULAR PHENOMENA IN THE ELECTRET STATE

M. Kasha, State University System of Florida, Florida State University, School of Arts & Sciences, Dept. of Chemistry, *205 Wildwood Dr., Tallahassee, Florida* 32306 (INT78-08503)

This award makes it possible for Dr. M. Kasha to carry out a cooperative research program with Dr. Sergio Mascarenhas of the Institute of Physics and Chemistry of the University of Sao Carlos, Brazil. They will work on elucidating the properties of electrets (electrostatic analogs of magnets) and their influence on molecular electronic phenomena.

They will prepare solid films which will serve as substrates for included molecules and will study changes in the phenomena of the included molecules with the production of the electret state. The work will concentrate on 1) absorption color changes, 2) intersystem crossings and radiationless transitions, and 3) decay times of triplet states, in the electret state. The research should have an impact in several areas of applied biophysics and image-forming technology.

SUPPORTED BY U.S. National Science Foundation, Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

3.0004, THE CHARACTERIZATION OF SODIUM THALLIUM TYPE AND RELATED COMPOUNDS VIA TRANSPORT, OPTICAL, AND MECHANICAL PROPERTIES

J.O. Brittain, Northwestern University, Evanston Campus, Technological Inst., Dept. of Materials Science & Engineering, *633 Clark St., Evanston, Illinois 60201 (DMR76-17157)*

The work will undertake the characterization of the intermetallic compounds of sodium-thallium (NaTl)-type and related compounds by transport, mechanical, structural and optical measurements. These measurements should provide information about the electronic states, the ionic motion and the nature of the defects in the materials. The specific research objectives are: (1) to characterize the defect state as a function of stoichiometry via x-ray diffraction and electron microscopy; (2) electronic conductivity, Hall effect and magnetoresistance will be determined as a function of stoichiometry (defect state); (3) microscopic atomic motion will be studied via nuclear magnetic resonance and amplitude independent internal friction; (4) chemical-ionic transport and lithium activity via electrochemical techniques; (5) optical properties will be correlated with the electronic, the defect state and the ionic conduction properties; and (6) a correlation will be attempted between mechanical properties and amplitude dependent internal friction.

The goal of this research is to increase the knowledge of the NaTl-type materials in order to enhance desirable mechanical, structural and mass transport characteristics. This study would be the first general scientific characterization of this family of intermetallic compounds. The knowledge gained would be significant for the various groups currently involved in materials problems associated with energy conversion technology, particularly in the area of anodes for high specific energy batteries.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0005, EXPERIMENTAL EVALUATION CRITERIA FOR CONSTITUTIVE MODELS OF TIME-DEPENDENT CYCLIC PLASTICITY

J.F. Martin, Michigan State University, School of Engineering, Dept. of Metallurgy Mechanics & Materials Sciences, *Engineering Bldg., East Lansing, Michigan* 48824 (NAG 3-51)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0006, COOPERATIVE RESEARCH ON THE MAGNETIC STRUCTURE AND INTER-ATOMIC DISTANCES IN RARE EARTH TRANSITION METAL ALLOYS

W.J. James, University of Missouri, Rolla Campus, Center for Materials Research, Dept. of Chemistry, *103 Parker Hall, Rolla, Missouri* 65401 (INT78-26549)

The award supports exchange of personnel for basic research in materials science between the Graduate Center for Materials Research and Chemistry, University of Missouri, and the Louis Neel Laboratory of Magnetism of the CNRS, Grenoble, France. The project takes place within the framework of the U.S.-France Cooperative Science Program of the National

Science Foundation (NSF) and the French National Center for Scientific Research (CNRS).

The project objective is to determine the magnetic structure and inter-atomic distances between magnetic atoms in a variety of rare earth transition metal alloys. The primary goal is to relate the structure of these alloys to their magnetic and electric properties. The project involves extensive use of precision lattice parameter X-ray, neutron diffraction, and high field magnetic flux studies. Compounds of the R6M23 phase will be studied, in which R represents a rare earth or mixture of rare earths - such as yttrium or thorium - and M represents a transition metal with differing composition of iron, manganese or aluminum. These compounds will be studied at normal and cryogenic temperatures, and at various compositions. The work may yield significant contributions to the understanding of, and possibilities of, synthesizing crystals of alloys having magnetic and superconducting properties.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

3.0007, THE ROLE OF COBALT IN NICKEL BASE SUPERALLOYS

J.K. Tien, Columbia University, School of Engineering & Applied Science, Dept. of Metallurgy, *Broadway & W. 116th St., New York, New York* 10027 (NAG 3-57)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0008, ADSORPTION, SEGREGATION AND REACTIONS AT METAL SURFACES

J.M. Blakely, Cornell University, Ithaca Campus, School of Engineering, Dept. of Materials Science & Engineering, *242 Carpenter Hall, Ithaca, New York* 14853 (DMR76-23537 A01)

Experimental research concerned with the structure and binding of adsorbed and segregated layers on solids, direct surface-vapor reactions, and surface catalyzed reactions previously supported by NSF grant DMR75-23647 will be continued. Specific projects to be carried out include: a study of the segregation and bonding of carbon atoms to transition metal surfaces and the effect of ordered adsorbed structures on surface reaction rates; a study of the mechanisms of adsorption and oxide formation on group II divalent metals (Be, Mg, Zn), and; a study of the interaction of halogens with silver single crystal surfaces with reference to surface catalyzed reactions and surface photographic processes.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Biological Behavioral & Social Sciences, Div. of Behavioral & Neural Sciences

3.0009, STRESS GENERATION IN THERMALLY GROWN OXIDE SCALES

R.D. Maier, Case Western Reserve University, School of Engineering, Dept. of Metallurgy & Materials Science, *University Cir., Cleveland, Ohio* 44106 (NAG 3-49)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0010, EVOLUTION AND ADHERANCE OF OXIDE FILMS FORMED ON NICKEL-ALUMINUM AND NICKEL-CHROMIUM-ALUMINUM ALLOYS

R.D. Maier, Case Western Reserve University, School of Engineering, Dept. of Metallurgy & Materials Science, *University Cir., Cleveland, Ohio* 44106 (NAG 3-58)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0011, CRACK INITIATION AND EARLY PROPAGATION UNDER THERMO-MECHANICAL LOADING

S.S. Manson, Case Western Reserve University, School of Engineering, Dept. of Metallurgy & Materials Science, *University Cir., Cleveland, Ohio* 44106 (NAG 3-46)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0012, THE HOT CORROSION OF METALS AND ALLOYS BY FUSED SALTS

R.A. Rapp, Ohio State University, Columbus Campus, School of Engineering, Dept. of Metallurgical Engineering, *190 N. Oval Dr., Columbus, Ohio 43210* (INT77-17720)

This award provides travel and subsistence costs to allow Dr. Robert A. Rapp of Ohio State University to visit and collaborate with Professor Kazuhiro Goto and his associates at the Tokyo Institute of Technology in the study of chemical and electrochemical aspects of hot corrosion of alloys. This project has been approved under the U.S.-Japan Cooperative Science Program and funds for participation of Japanese scientists will be provided by the Japan Society for the Promotion of Science. Basic support for the domestic phase of this research has been provided through NSF grant DMR77-15575. Rapp will direct studies of base metals and alloys coated with thin layers of the fused salts Na2SO4 and Na2CO3 at elevated temperatures in contact with reactive gases, the redox potential of a corroding electrode and the basicity of the salt film, during hot corrosion attack on a metal, and simultaneous monitoring of the electrochemical corrosion current and the gravimetric changes during hot corrosion of metals by thin fused salt coatings. Professor Goto's group will carry out studies of the electrochemistry of the oxygen reduction step on various metal and oxide electrodes in Na2SO4 and Na2CO3. It is expected that the fundamental studies of the pulse-electrochemistry of anodic polarization of metals and the dissolution and diffusion of oxygen in Na2SO4 and Na2CO3 in Tokyo will, with the experimentation at Ohio State University, allow a detailed mechanism for hot corrosion to be developed.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

3.0013, PRELIMINARY STATIC IMPACT TESTING OF BORON ALUMINIUM COMPOSITE TIP PANELS

S.J. Bless, University of Dayton, Research Inst., *300 College Park Ave., Dayton, Ohio* 45469 (NAS 3-22353)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0014, APPLY SPECIAL COATINGS TO ELECTROPHORESIS COLUMNS AND MEASURE ANTI-ELECTROOSMOSIS VALUES OF COATED COLUMNS AND PREDICT TEST RESULTS

J.W. Vanderhoff, Lehigh University, School of Arts & Sciences, Dept. of Chemistry, *Alumni Memorial Bldg., Bethlehem, Pennsylvania* 18015 (NAS 9-16071)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

3.0015, INVESTIGATION INTO THE ROLE OF NAC DEPENDENCY ON OXIDE AND METAL SUBSTRATES IN THE INITIATION OF HOT CORROSION

N. Birks, University of Pittsburgh, School of Engineering, Dept. of Metallurgical & Materials Engineering, *402 Engineering Hall, Pittsburgh, Pennsylvania* 15213 (NAG 3-44)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0016, HOT TENSILE TESTS OF INCONEL 718 MICROFISSURING OF EB WELDS IN INCONEL 718
R.G. Thompson, Clemson University, School of Engineering, Dept. of Materials Engineering, *Rhodes Research Bldg., Clemson, South Carolina* 29631 (NAS 8-33524)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

3.0017, SOLID STATE CHEMISTRY OF DEFECT SITES IN FLUORITE CRYSTALS
J.C. Wright, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Chemistry, *500 Lincoln Dr., Madison, Wisconsin* 53706 (DMR79-06788)

Fluorite materials occupy a prominent position in the understanding of solid state chemistry, and in the control defects exert on that chemistry. Experiments that relate to solid state defect chemistry of fluorites include diffusion; dielectric loss and relaxation; thermal, electrical, and ionic conductivity; color center formation; and photochromaticity. Some fluorites also undergo transition to a superionic state at high temperatures and others can become semiconductors after reduction. Despite the excellent agreement that has existed between theory and experiment for many years, there have been several experiments that have been in marked disagreement with the existing theories.

Laser spectroscopy and electron paramagnetic resonance (EPR) spectroscopy are being used in this project to measure the absolute concentrations of all the defect sites that result when lanthanide ions are introduced into CaF2. Measurements are made as a function of the temperature of the crystal before quenching and of the lanthanide concentration. These measurements provide a detailed description of all defect equilibria. They are then compared with a new model for the defect equilibria which postulates a covalent interaction between fluoride interstitial ions and clusters. This model is marked departure from the commonly accepted model since it predicts the equilibria are controlled by clustering phenomena instead of a simple pairing between defects.

First year of a three-year continuing grant; renewal of work supported by DMR77-17765.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, INVESTIGATION OF DEGRADATION PROCESS OF INSULATING MATERIALS
C.V. Doreswamy, Tuskegee Inst., School of Engineering, Dept. of Electrical Engineering, *Tuskegee Institute, Alabama* 36088 (NAG 8-5)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

4.0002, SIZE AND VELOCITY DISTRIBUTIONS OF PARTICLES AND DROPLETS IN SPRAY COMBUSTION SYSTEMS
E.D. Hirleman, Arizona State University, School of Engineering & Applied Sciences, Dept. of Mechanical Engineering, *Tempe, Arizona* 85281 (DN975361; N00014-79-C-0363)

The objective of this research program is to perform in-situ, simultaneous measurements of sizes and velocities of individual particles and droplets in spray combustion systems and to study the effect of particle distribution on heterogeneous combustion processes. The results of this theoretical and experimental research program are needed for combustor modeling studies, and for nozzle and exhaust flow characteristics to provide understanding and enhancement of future jet engine design.

Design and application end of a new laser technique will be made to charaterize fuel spray droplet properties in a cold flow system, with following effort directed to hot flow and practical combustion systems. The method utilizes two parallel Gaussian laser beams separated by a known spacing with particles traversing the two beams being scattered with fluorescing laser radiation to a photosensitive detector. The detected signature from an individual particle is analyzed to determine two velocity components and the incident intensity history.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0003, COMBUSTION AND POLLUTANT EMISSIONS CHARACTERISTICS OF COAL-DERIVED LIQUID FUELS
C.T. Bowman, Stanford University, School of Engineering, Dept. of Mechanical Engineering, *Stanford, California* 94305 (DN975359; N00014-79-C-0318)

The objective of this research program is to investigate and measure key combustion and pollutant emission characteristics of hydrocarbon fuels which are representative of coal-derived liquid fuels. This information is essential in the design of efficient and clean combustors utilizing such fuels and ultimately should lead to improved propulsion systems for naval aircraft and weaponry applications.

Experiments will be carried out using a laminar, one-dimensional monodisperse hydrocarbon aerosol-air flame. Combustion rates will be determined by measurement of droplet burnout rate, the rates of evolution of CO, CO2, and the rate of increase of temperature; pollutant formation and destruction rates will be determined from measured no and soot concentrations - all by advanced laser-based diagnostic and isokinetic probe techniques.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0004, ION BEAM MICROTEXTURING OF SURFACES
R.S. Robinson, Colorado State University, School of Natural Sciences, Dept. of Physics, *Fort Collins, Colorado* 80523 (NAG 3-43)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0005, MAGNETIC AND OPTICAL PROPERTIES OF DOPED YTTRIUM ION GARNET
S. Geller, University of Colorado, Boulder Campus, School of Engineering & Applied Science, Dept. of Electrical Engineering, *1200 University Ave., Boulder, Colorado* 80302 (INT77-15142)

This award will support cooperative research between the Universities of Colorado and Rome. The work to be supported is concerned with yttrium iron garnets (known commercially as YIG) and used, for instance, in lasers and light switching devices. The main thrust of the work is to prepare new compositions of these crystals by adding controlled amounts of desired impurity atoms, and to characterize the magnetic and spectroscopic properties of the new materials. The goal of the work is to understand in a fundamental way how such dopants alter the properties of these substances.

The work in Rome is mainly on the magneto-optical properties, and the work in Colorado is primarily on the magnet properties, materials preparation and X-ray diffraction investigations.

SUPPORTED BY U.S. National Science Foundation, Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

4.0006, DYNAMIC CHARACTERISTICS OF LINEAR HYDROSTATIC GAS BEARINGS
C.B. Watkins, Howard University, School of Engineering, Dept. of Mechanical Engineering, *2400 6th St. N.W., Washington, District of Columbia* 20001 (NAG 5-25)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

4.0007, MECHANISMS OF LEAN LIMIT EXTINCTION
C.K. Law, Northwestern University, Evanston Campus, Technological Inst., Dept. of Mechanical Engineering, *633 Clark St., Evanston, Illinois* 60201 (NAG 3-53)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0008, IMPACT OF MICROPROCESSORS ON EMC
B.J. Leon, Purdue University, Purdue Research Foundation, *Life Sciences Bldg., West Lafayette, Indiana* 47907 (R; F30602-75-C-0082)

The objective of this effort is to allocate 30,000 dollars to Purdue University under the RADC post-doctoral program. This effort is to determine the impact of the increasing use of microprocessors/microcomputers on the electromagnetic compatability of Air Force systems. Topics of concern are: assessment of the state-of-the-art of microprocessors/microcomputers vis-a-vis Air Force requirements, survey of present and future Air Force usage, assessment of the potential of microprocessors/microcomputers as an aid in EMC control (i.e., preprogrammed filter tuning, frequency management devices, etc.), and development of recommendations for research efforts which would provide system designers with the information required to account for the EMC impact of microprocessors/microcomputers (microsystems) in Air Force systems.

The approach is (1) state-of-the-art of 'microsystems'/Air Force requirements, (2) survey of present and future Air Force usage, e.g., Air Force digital flight control system, digital avionics information system, (3) determination of EMC problems relative to 'microsystems' chip, package, leads, associated circuits under both static and dynamics conditions, (4) applicability of classical EMC fixes, i.e., shielding, filtering, etc, (5) examination of potential of 'microsystems' for EMC control applications, and (6) future studies to implement guidelines for system designers.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0009, ZERO MODULES AND INVERSE SYSTEM DESIGN
M.K. Sain, University of Notre Dame, School of Engineering, Dept. of Electrical Engineering, *Notre Dame, Indiana* 46556 (NAG 2-35)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

4.0010, DATA FLOW COMPUTER ARCHITECTURE
J.B. Dennis, Massachusetts Inst. of Technology, School of Engineering, Dept. of Electrical Engineering & Computer Science, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (MCS75-04060 A01)

This project continues to explore and evaluate computer systems capable of direct, highly parallel execution of programs expressed in data flow representations. Program representations based on the data flow concept expose the concurrency of program fragments for exploitation by computers of appropriate architecture and provide an attractive form of base language for the modular construction of well-structured programs. This research has yielded proposals for highly parallel computation processors for three levels of data flow language: a language suitable for simple signal processing computations; an intermediate language, containing conditional and iterative constructs; and a complete data flow representation on the level of Algol, incorporating procedures and data structures. Processors to implement these languages have been developed around the principles of Packet Communication Architecture: each processor is composed of units which communicate through the transmission of information packets, and delays in packet transmission do not affect correct operation of the system. Methods to analyze the characteristics of such processors in terms of design, performance, and applications have been developed, and further work is necessary in these areas.

This research grant will support: further exploration of the architectural principles of Packet Communication Systems, such as data flow processors; the feasibility of such processors in terms of cost, performance, structure, programmability, fault-tolerance, and implementation technologies; and an investigation of the application of data flow computers to such significant problems areas as air traffic control, numerical weather forecasting, and signal processing. This is a renewal of Grant No. DRC75-04060.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Mathematical & Computer Sciences

4.0011, THE INFLUENCE OF GYROSCOPIC FORCES OF THE DYNAMIC BEHAVIOR AND FLUTTER OF ROTATING BLADES
F. Sisto, Stevens Inst. of Technology, School of Engineering, Dept. of Mechanical Engineering, *Castle Point Station, Hoboken, New Jersey* 07030 (NAG 3-47)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0012, PULSE CODE MODULATION DECODER, MODEL GIAF-2
B.G. Gammill, New Mexico State University, Las Cruces Campus, Graduate School, *University Park, Las Cruces, New Mexico* 88003 (NAS 6-3087)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Wallops Flight Center

4.0013, DESIGN, FABRICATE AND TEST PRIME FOCUS FEEDS FOR PARABOLIC EARTH STATION ANTENNAS FOR THE 12 GHZ BROADCAST SATELLITE SERVICE
R.E. Collins, Case Western Reserve University, School of Engineering, Dept. of Electrical Engineering & Applied Physics, *University Cir., Cleveland, Ohio* 44106 (NAS 3-22342)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0014, FLUCTUATING SHEAR FLOWS
G.D. Catalano, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF142670)

This effort supports the development of the airborne pointing and tracking systems and advanced laser aerodynamic applications. The problem area to be addressed is that very little velocity information is presently available concerning the fluctuating shear flows over open ports in airborne applications. This information will aid in the design of the open ports. The technical objective of the work is to obtain a more precise understanding of the large scale structure of turbulence present in the fluctuating shear flows. The data generated will contribute to the effectiveness of future combat aircraft containing radiation subsystems for projection and detection in passive and active roles.

Develop a laser doppler velocimeter (LDV) which can measure turbulent velocity fields in subsonic, transonic, and supersonic fluid regimes. Make measurements in a two dimensional jet with the LDV and compare those measurements with data obtained from a hot wire anemometer. After the accuracy and reliability of the LDV has been established, probe the turbulent flow over an open port. Emphasis will be placed on measuring statistical properties which will lend visibility to the large scale turbulent structure of the flow field. Supplement this experimental investigation with a theoretical analysis of dusty gas flows. Several flow configurations will be analyzed including stagnation regions, wavy walls, and backward facing steps.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0015, SELF ADAPTIVE SOLUTIONS STRATEGIES
J. Paulson, University of Akron, School of Engineering, Dept. of Mechanical Engineering, *302 E. Buchtel Ave., Akron, Ohio* 44304 (NAG 3-54)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0016, HELICOPTER TRANSMISSION RELIABILITY MODEL
M. Savage, University of Akron, School of Engineering, Dept. of Mechanical Engineering, *302 E. Buchtel Ave., Akron, Ohio* 44304 (NAG 3-55)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0017, SPECIAL FOREIGN CURRENCY AWARD (INCLUDING EGYPTIAN CURRENCY) FOR THE STUDY OF APPLICATION OF REMOTE SENSING TECHNIQUES (ABBREV)
M.A. Hady, Oklahoma State University, School of Engineering, Dept. of Civil Engineering, *Engineering N., Stillwater, Oklahoma* 74074 (INT71-01736 A06)

This proposal details the second phase of a current four-year project which started in Dec. 1975, for the applications of modern remote sensing techniques to regional and national resources development projects in Egypt, under the grant OIP71-01736 A04. Results were published in 15 papers presented in International Conferences, as well as 14 technical reports. The work conducted represents great advances in the applications of LANDSAT and aircraft remote sensing technology to investigation of natural resources, large irrigation, power generation, agriculture projects and environmental studies. Also, basic scientific theories and certain unique problems in the areas of geology, groundwater and soils have evolved.

The second phase program will continue to demonstrate the full utilization of the capabilities of remote sensing techniques, whether from satellites or aircraft, in major development projects in Egypt, apart from the basic scientific research and advancement of the working techniques themselves. Also, special emphasis will be given to the phenomena of desertification and desert development and encroachment on the agricultural areas on the fringes of the Western Desert of Egypt. Full utilization of the newly installed Multispectral Data Analysis System (M-DAS) and the recently acquired high-ceiling Beech King (A-200) aircraft will be achieved.

SUPPORTED BY U.S. National Science Foundation, Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

4.0018, STUDY TO EVALUATE THE USE OF AN OPTICAL PATTERN RECOGNITION SYSTEM
D. Casasent, Carnegie Mellon University, Carnegie Inst. of Technology, Dept. of Electrical Engineering, *Frew Ave. & Margaret Morrison, Pittsburgh, Pennsylvania* 15213 (NAS 1-16125)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0019, SPACE SHUTTLE MAIN ENGINE FUEL TURBOPUMP INTERSTAGE SEAL TEST PROGRAM
M. McDermott, Texas A & M University, College Station Campus, School of Engineering, Dept. of Mechanical Engineering, *P.O. Box F E 44, College Station, Texas* 77843 (NAS 8-33716)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

4.0020, X-RAY TOPOGRAPHY STUDY OF COMPLEX SILICONE MICROCIRCUITS
P.L. Parker, Texas A & M University, College Station Campus, School of Engineering, Dept. of Electrical Engineering, *P.O. Box F E 44, College Station, Texas* 77843 (NAS 8-33519)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

4.0021, SPACE FLIGHT DESIGN AND DEVELOPMENTAL STUDIES
H.E. Blackwell, Texas Southern University, School of Arts & Sciences, Dept. of Physics, *3201 Wheeler Ave., Houston, Texas* 77004 (NAG 9-6)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

4.0022, INVESTIGATION FOR SEARCH AND RESCUE DOPPLER PROCESSOR DEVELOPMENT
S.G. Wilson, University of Virginia, School of Engineering & Applied Science, Dept. of Electrical Engineering, *Garrett Hall, Charlottesville, Virginia* 22903 (NAS 5-26011)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

4.0023, NIMBUS TYPE PRESSURE MODULAR DRIVE
Unknown, University of Oxford, *S. Parks Rd., Oxford, England, United Kingdom* (NASW 3301)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, MATRIX PHASES OF CARBONACEOUS CHONDRITES
P.R. Buseck, Arizona State University, School of Liberal Arts, Dept. of Geology, *Tempe, Arizona* 85281 (NAG 9-4)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

5.0002, OPERATIONAL APPLICATIONS OF SATELLITE SNOWCOVER OBSERVATIONS AND DCS OPERATIONS IN THE ARIZONA TEST SITE
H.H. Schumann, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Phoenix, Arizona* (AZ 75-041)

The LANDSAT, NOAA, and SMS/GOES satellite imagery will be the primary source of repetitive remote-sensing data over central Arizona for obtaining snow-covered areas on the Salt and Verde River watersheds. These data will be supplemented by repetitive aerial surveys and supporting ground-truth relayed by the ERTS DCS. The ERTS data collection platforms will relay hydrologic and meteorological data from key locations to aid in interpretation of the imagery and to demonstrate the ability of satellite telemetry systems to furnish timely and meaningful hydrologic information for use by water management.

A. To evaluate repetitive satellite imagery together with aerial surveys in an attempt to develop an operational capability in Arizona for using satellite imagery for mapping the distribution of snowcover on the Salt and Verde River watersheds. B. To develop techniques and procedures for systematic monitoring of snowcover and moisture conditions using remote sensor methods together with the use of the ERTS data collection system to relay ground truth data in near real-time.

The ERTS-1 and NOAA-2 imagery will be the primary source of repetitive remote-sensing data over central Arizona for obtaining snow-covered areas on the Salt and Verde River watersheds.

Report written and reviews taken care of.

Submit report for approval to NASA.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0003, TERRAIN MODELS FOR OPTIMUM SAR SENSOR CONFIGURATION & FOR EXPLORATION OF GLOBAL NON-RENEWABLE RESOURCES (ABBREV)
H.C. MacDonald, University of Arkansas, Fayetteville Campus, School of Arts & Sciences, Dept. of Geology, *Fayetteville, Arkansas* 72701 (NAG 9-3)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

5.0004, MEASUREMENT OF SOIL MOISTURE USING REMOTE SENSING MULTISENSOR TRANSFER TECHNIQUES
W.P. Waite, University of Arkansas, Fayetteville Campus, School of Engineering, Dept. of Electrical Engineering, *Fayetteville, Arkansas* 72701 (NAG 5-20)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0005, REMOTE SENSING FOR SOIL SURVEY AND LAND USE
J.E. Cipra, Colorado State University, School of Agricultural Sciences, Dept. of Agronomy, *Fort Collins, Colorado* 80523 (0079694; COL00139)

OBJECTIVE: Investigate the use of remote sensing technology in soil survey and land inventory through innovative survey and interpretation techniques, as an aid to accelerating the Colorado Soil survey program. Coordinate the use of remote sensing technology within National Cooperative Soil Survey in the state of Colorado.

APPROACH: An area in Colorado which has an active soil survey in progress will be selected in collaboration with the State Soil Scientist. LANDSAT imagery will be obtained and initial computer analysis will be performed. Image products will be delivered to the field survey Party Chief, and SCS personnel will be briefed on the characteristics and possible ways of using the products. The field party will evaluate the image products and suggest changes as appropriate. Additional research involving the use of ground information, image contrast stretching, and other computer analysis techniques will be investigated as appropriate. A central focus throughout the project will be to develop and test techniques in remote sensing which will make an immediate, positive contribution to the field soil survey program.

SUPPORTED BY Colorado State Government

5.0006, REMOTE SENSING AS A SOURCE OF DATA FOR STATE AND LOCAL AGENCIES
E. Maxwell, Colorado State University, School of Forestry & Natural Resources, Dept. of Earth Resources, *Fort Collins, Colorado* 80523 (0073828; COL00016)

OBJECTIVE: Compare remote sensing to more conventional modes of data collection; determine data adequacy and cost-effectiveness of various methods of processing remote sensing data; work with various state agencies to determine data needs and to evaluate opportunities to meet data needs with remote sensing methods; evaluate organizations and equipment for possible use in providing the state with the image processing capabilities.

APPROACH: This project will be carried out by maintaining close working relations with interested state and local agencies. Specific problem areas identifiable at this time include: Drought assessment, conversion of ag land, monitoring agricultural production, mapping land use and obtaining ag statistics on an annual basis as a problem alert system. Various remote sensing systems and data processing methods will be considered for each application.

PROGRESS: The analysis of center pivot irrigation (CPI) systems was completed and a report was issued. It was determined that a single LANDSAT image was not adequate to accurately count CPI systems. Images from two or three dates during the growing season are needed if the count is to be within 10 to 15% of the total. All of the installations will not be seen on LANDSAT. The accuracy of land-use and vegetation mapping from computer analysis of LANDSAT data was analyzed for vegetation maps produced on another project. This study of accuracy or verification procedures was only partly funded by project 0016. The data analyzed were from the Piceance Basin region in Northwest Colorado. This type of analysis will help state agencies assess the usefulness of remote sensing data. Achieving a high degree of correspondence between the meaning or interpretation of land cover classes is a major problem which must be overcome if meaningful evaluations are to be made. Research has begun on the use of multitemporal LANDSAT digital data to detect changes in land cover. Specifically, we are attempting to detect urban encroachment onto agricultural land over two to five-year periods. To date, we have statistically analyzed LANDSAT digital data of urban and agricultural areas over a six-month period (May though October) to determine the optimum date(s) and most informative LANDSAT spectral band(s) for separating urban agricultural spectral signatures.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, Colorado

5.0007, THEORETICAL WAVE AND TURBULENCE
J. Weinstock, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., *Boulder, Colorado* 80302 (8DJ40822)

PROJECT OBJECTIVE: Conduct theoretical research on waves and turbulence which occur in the earth's atmosphere and their effect on atmospheric transport. Such processes include gravity waves, mass, charge, energy transport and eddy diffusion. They greatly influence pollution dispersal and meteorological predictions.

CURRENT YEAR PLAN: 1. Deduce turbulence parameters in the lower atmosphere from Sunset Radar data. 2. Use Noxon's observations of airglow fluctuations to study dynamics in the mesosphere and thermosphere. 3. Continue comprehensive theory of turbulence in stably stratified atmospheres. 4. Determine contribution of gravity waves to atmospheric transport above 30 km. 5. Nonlinear theory of shear-flow instability. 6. Initiate study of the influence of planetary waves on transport in the stratosphere.

PROGRESS REPORT: 1. Developed theory that determines oxygen distribution and gravity wave characteristics in the lower thermosphere from fluctuations of airglow emissions. 2. Determined the contribution of turbulence to vertical transport in the stratosphere. 3. Completed work on Lagrangian theory of turbulent diffusion. 4. Completed 'three-point' method for solving problems in homogeneous turbulence. 5. Began comprehensive theory of turbulence in a stably stratified atmosphere. Determined influence of bouyancy on vertical transport.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab.

5.0008, GRAVITY MEASUREMENTS IN SUPPORT OF LONG BASELINE GEODESY
J.H. Whitcomb, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Geological Sciences, *1200 University Ave., Boulder, Colorado* 80302 (NAG 5-21)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0009, MODELING OF TECTONOPHYSICAL DISTORTION FROM MEASUREMENTS OF LONG-BASELINE GEODETIC DATA AND OTHER
J.H. Whitcomb, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Geological Sciences, *1200 University Ave., Boulder, Colorado* 80302 (NAG 5-22)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0010, EVALUATION OF REMOTE-DATA ACQUISITION SYSTEMS IN WEST-CENTRAL FLORIDA
W.M. Woodham, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Tampa, Florida* (FL 76-263)

Increasing number of developments on waterfront property that is subject to frequent and severe flooding and demands being placed on available water resources in west-central Florida require current hydrologic information on existing ground and surface water conditions in the Southwest Florida Water Management District. Current hydrologic data must be available for water managers to protect local and regional water resources. Current data needs include water levels of key lakes and over developed well field areas, and monitoring extreme flow conditions.

Objectives include acquisition, testing, and evaluation of a telemeter system composed of satellite and land-line telemeters. Results obtained in this evaluation will be used as a basis for developing a large-scale telemeter system for the Southwest Florida Water Management District.

Battery powered digital telemeters will be obtained and operated at key data stations. Six telemeters will be operated via GOES Satellite, two by LANDSAT Satellite, and one by telephone line. Telemetry data will be processed on the Survey computer system and a locally owned minicomputer. Operational characteristics of the system will be evaluated and a brief report prepared.

Network stations installed and operated during year include 5 additional GOES Satellite Convertible Data Collection platforms (CDCP). A total of 6 CDCP's, 2 LANDSAT, and 1 land line telemeter were operational by end of FY78. Telemetry data is continuing to be evaluated and report is in review process.

Continue evaluation of data from present network and prepare a final report.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0011, STUDY ENTITLED SOIL RADAR RESPONSE STUDY
W.J. Steinway, Georgia Inst. of Technology, Engineering Experiment Station, *225 North Ave. N.W., Atlanta, Georgia* 30332 (NAS10-9757)

SUPPORTED BY U.S. National Aeronautics & Space Admin., John F. Kennedy Space Center

5.0012, MEASUREMENT OF SOIL USING REMOTE SENSING ACTIVE MICROWAVE TECHNIQUES
F.T. Ulaby, University of Kansas, Lawrence Campus, School of Engineering, Dept. of Electrical Engineering, *Learned Hall, Lawrence, Kansas* 66044 (NAG 5-30)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0013, CONDUCT SHORT COURSES IN REMOTE SENSING
C.A. Whitehurst, Louisiana State University, Agricultural & Mechanical College, School of Engineering, Dept. of Mechanical Engineering, *University Station, Baton Rouge, Louisiana* 70803 (NAS13-142)

SUPPORTED BY U.S. National Aeronautics & Space Admin., National Space Technology Lab.

5.0014, TECHNOLOGY TRANSFER TO SUB-STATE LEVELS OF GOVERNMENT
C.A. Whitehurst, Louisiana State University, Agricultural & Mechanical College, School of Engineering, Dept. of Mechanical Engineering, *University Station, Baton Rouge, Louisiana* 70803 (NAS13-148)

SUPPORTED BY U.S. National Aeronautics & Space Admin., National Space Technology Lab.

5.0015, DEVELOPMENT AND APPLICATION OF PHOTOGRAPHIC TECHNIQUES OF REMOTE SENSING
G. Cooper, University of Maine, Orono Campus, Agricultural Experiment Station, Dept. of Botany & Plant Pathology, *Winslow Hall, Orono, Maine* 04469 (0071745; ME08494)

OBJECTIVE: Explore the use and efficiency of photographic remote sensing in low intensity soil surveys. Develop the use of aerial photographic ocean and estuary surveys on the Maine Coast. Accumulate, as a result of ongoing research, material for a remote sensing atlas of Maine's herbaceous vegetation. Explore various aspects of disease problems in apples and blueberries using aerial photographic techniques.

APPROACH: All objectives are being explored using existing research land and personnel. All photography is low level and intended to expand the work already underway. Except for underwater detail, as in objective 2, the work is concentrated on the use of black and white and color infrared imagery.

PROGRESS: 1. Cooperative work with the Soil Conservation Service has moved forward to research in the 'big woods' area and will be continued by that agency. 2. Progress on surveying clear cut operations for tree regeneration has been successful and the U.S.F.S. will continue the work. 3. Preliminary work on blueberries is very promising and will probably be continued. 4. Development of infrared video is underway and will be continued. 5. Methodology has been studied on the survey of marine algae and looks promising. May be continued. 6. Field and aerial surveys of 'Land Fill' dumps indicates potential use in surveying for toxic materials.

SUPPORTED BY Maine State Government

5.0016, FOREST VOLUME TABLES USING AERIAL PHOTOGRAPHY
T.B. Brann, University of Maine, Orono Campus, School of Forest Resources, McIntire Stennis Program, *302 Boardman Hall, Orono, Maine* 04473 (0074826; ME09616)

OBJECTIVE: Adapt existing Volume Tables for Maine to reflect current merchantable use of trees. Develop volume tables based on aerial photography techniques.

APPROACH: Volume tables for commercial species will be constructed for tree diameter classes of 1 to 40 inches, and utilization limits as small as 1 inch. Volume tables will be correlated with aerial photograph measurements to provide aerial volume tables for Maine cover types. Optical dendrometry measurement techniques will be used to obtain data describing stem form for each species under study. Tree taper functions will be developed using current statistical techniques. Volume tables to any minimum diameter limit will be generated using the above taper functions. Application of aerial photograph measurement to classify stands by Diameter class, height class and volume class. Intensive ground verification will be correlated with photograph measurements during the aerial volume table development process.

PROGRESS: The stem analysis data essential to the construction of a flexible system of volume prediction equations for spruce and fir was collected. A Fortran IV computer program was completed which calculates, from stem analysis data, the total stem cubic volume and merchantable cubic volume to any designated top limit diameter. A Fortran IV computer program which solves from the non-linear regression coefficients of total stem volume and merchantable volume ratio equations has also been completed. The first set of volume tables (spruce and fir) will be completed in early fall.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, Maine

5.0017, INTERPRETATION AND DELINEATION OF THE EARTH'S GRAVITY FIELD
B.D. Marsh, Johns Hopkins University, School of Arts & Sciences, Dept. of Earth & Planetary Sciences, *34th & Charles Sts., Baltimore, Maryland* 21218 (NAG 5-32)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0018, PETROLOGIC AND GEOPHYSICAL STUDY OF THE SOURCE OF LONG WAVELENGTH CRUSTAL MAGNETIC ANOMALIES

B.D. Marsh, Johns Hopkins University, School of Arts & Sciences, Dept. of Earth & Planetary Sciences, *34th & Charles Sts., Baltimore, Maryland* 21218 (NAG 5-35)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0019, RELATING THEMATIC MAPPER BANDS TO AGRONOMICS VARIABLES FOR SOYBEANS AND CORN

C.J. Fan, Morgan State University, Graduate School, *Hillen Rd. & Cold Spring Ln., Baltimore, Maryland* 21212 (NAG 5-12)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0020, EVALUATION OF THE QUALITY OF RAINFALL INTENSITY ESTIMATES

N. Knox, Morgan State University, Graduate School, *Hillen Rd. & Cold Spring Ln., Baltimore, Maryland* 21212 (NAG 5-14)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0021, SATELLITE ALTIMETRY

B. Chovitz, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Ocean Survey, Geodetic Research & Development Lab., *6001 Executive Blvd., Rockville, Maryland* 20852 (836910A5)

Measurements of altitude to the ocean surface from a satellite will provide, in the first approximation, information on the shape of the geoid assuming that sea level corresponds to the geoid, and in the second approximation information on tides, currents, salinity, and sea state which are deviations of sea level from an equipotential surface. The first use of satellite altimetry will therefore be geodetic and serve as a basis for the later oceanographic applications. The altimetry will provide direct dense measurements of geoidal heights on a global scale not possible by any other means. It will also aid in improving the figure of the Earth as a whole in combination with other data.

Technical objective is to carry out analyses and provide computer programs in anticipation of data to be received from satellite altimetry. These programs not only handle altimetry, but provide a precise ephemeris of the satellite, which is required to exploit the precision of the altimetry.

Task is of ongoing nature. It is anticipated that a continuously improving flow of data from successive NASA satellites will be forthcoming through this decade. Technical reports of progress will be issued when significant results have been achieved.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Ocean Survey

5.0022, AFOS FORECAST APPLICATIONS - AFOS-ERA VERIFICATION

H.R. Glahn, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Weather Service, Systems Development Office, Techniques Development Laboratory, *8060 13th St., Silver Spring, Maryland* 20910 (8C27026)

OBJECTIVE: To develop an automated system to collect, archive, and verify both NWS official forecasts and MOS forecasts.

APPROACH: Locally a program will be implemented at a WSFO to collect the official forecasts, MOS forecasts, and verifying observations for selected stations in that forecast area. This collected set of forecasts and obs will be 1) stored for local statistical routines to access, 2) available for display by the forecaster, and 3) transmitted on the NDC to NWSH. Centrally a computer program will be implemented on the IBM 360/195 to accept input from WSFO's and produce a national verification summary. A system will be developed to permanently archive these forecasts.

PROGRESS: The coding of the local collation program is complete, and testing of this software has started. The program to produce verification summaries was completed. Preliminary plans for a permanent archive system were developed.

SUPPORTED BY U.S. Dept. of Commerce, National Weather Service, Systems Development Office

5.0023, SYSTEMS DEVELOPMENT AND EXPERIMENTATION - DATA ACQUISITION

R.C. Lee, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Weather Service, Systems Development Office, *8060 13th St., Silver Spring, Maryland* 20910 (8C27035)

TECHNICAL OBJECTIVE: To interface automated data acquisition systems to AFOS.

APPROACH: Analyze the interface requirements for automated data acquisition systems (AHOS/T, RADAP, AMOS, RAMOS and Upper Air) in terms of data loading, transmission time and line cost. Develop a network design and specify types and quantity of lines, data compression techniques and collection points. Add data collection capabilities to the detailed forecast area designs.

PROGRESS: Data acquisition study has been completed and communication requirements for data acquisition sites are defined as follows: 1. AHOS-T data collection should be done by AFOS automated WSO's utilizing the direct distance dialing (DDD) system. 2. In the AFOS era, ADAS sites will be utilized to collect data from RAMOS sites and for ad hoc collections from AHOS-T sites. WATS lines will be used in both cases. 3. ADAS sites and RADAP will interface with the AFOS network via 2400 bps dedicated lines using ADCCP. 4. Data from many Upper Air sites will be collected via a communications line that will be shared with either a collocated RADAP system or an AFOS terminal.

SUPPORTED BY U.S. Dept. of Commerce, National Weather Service, Development Div.

5.0024, TERMINAL WEATHER PREDICTION - MEDIUM-RANGE AVIATION FORECASTING

R.G. Miller, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Weather Service, Systems Development Office, Techniques Development Laboratory, *8060 13th St., Silver Spring, Maryland* 20910 (8D5905)

TECHNICAL OBJECTIVE: To develop and implement new and improved automated techniques for the prediction of aviation weather elements at terminals.

APPROACH: The basic method used is the application of Model Output Statistics (MOS). Generalized operator prediction equations for regional areas or, when possible, single-station prediction equations are developed from a record of numerical model output. These statistical prediction equations are then used with operational numerical model predictions to produce automated forecasts.

PROGRESS: An improved medium-range forecast system, with several innovative features, became operational in FY 1977. Automated probability forecasts for six categories each of ceiling and visibility are routinely available for 233 U.S. terminals four times each day on request/reply teletypewriter circuits. We now provide an early aviation guidance package to field forecasters approximately 2 hr sooner than the previous system allowed.

The new features of our improved system are: (a) Monthly climatological variables, interpolated to daily values, are used as predictors. (b) Prediction equations for ceiling were developed simultaneously with those for cloud amount to improve the consistency between forecasts of these two elements. (c) Three-category combined ceiling/visibility forecasts, used at NMC as guidance for their products, are extracted from the six-category forecasts. This procedure makes the two types of terminal forecasts consistent with each other. (d) Threshold probabilities are used to transform the probability forecasts into a 'best' category type. This feature improves the bias characteristics of the lower category forecasts which were seriously underestimated in the previous system.

Work began on testing two new statistical techniques for producing terminal weather forecasts based on numerical model

output. The first, Transnormalized Regression Probability (TRP) is a version of linear regression. The second new technique is a modification of the Regression Estimate of Event Probability (REEP) procedure. It is a nonlinear multivariate method known as Discrete Likelihood Functions (DLF).

SUPPORTED BY U.S. Dept. of Commerce, National Weather Service, Systems Development Office

5.0025, DATA AUTOMATION - AUTOMATIC METEOROLOGICAL OBSERVING SYSTEM (AMOS IV)

R.R. Reynolds, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Weather Service, Systems Development Office, Equipment Development Laboratory, *8060 13th St., Silver Spring, Maryland* 20910 (8AA8602)

OBJECTIVE: To totally automate the surface weather observation.

APPROACH: Procure sub-system (to reduce in-house design requirements). Develop software to automate basic parameters. Incorporate ceilometer, visibility and present weather sensors.

PROGRESS: Version 1.0 software and hardware running at T&ED. This version processes temperature, dewpoint, winds, pressure and visibility, and accepts limited remarks. It does not provide for quality control of the data, however.

SUPPORTED BY U.S. Dept. of Commerce, National Weather Service, Systems Development Office

5.0026, RESEARCH OF PENUMBRAL SURGES AND THEIR PHYSICAL RELATIONSHIPS TO SOLAR FLARES

E.J. Schmadl, University of Maryland, College Park Campus, Graduate School, *College Park, Maryland* 20742 (NAG 5-29)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0027, RESEARCH OF SEA-AIR-LAND INTERACTION IN CLIMATE MODELING

F. Baer, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Meteorology, *College Park, Maryland* 20742 (NAG 5-26)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0028, RESEARCH RELATIVE TO THE DEVELOPMENT OF HYDROLOGIC MODELS FOR REMOTE SENSING TECHNOLOGY

R.M. Ragan, University of Maryland, College Park Campus, School of Engineering, Dept. of Civil Engineering, *College Park, Maryland* 20742 (NAG 5-9)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0029, RESEARCH ON THEORIES FOR MICROWAVE REMOTE SENSING FLOW

J.A. Kong, Massachusetts Inst. of Technology, School of Engineering, Dept. of Electrical Engineering, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NAG 5-16)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0030, SEISMICITY AND ACTIVE TECTONICS OF THE ANDES AND THE ORIGIN OF THE ALTIPLANO

P. Molnar, Massachusetts Inst. of Technology, School of Science, Dept. of Earth & Planetary Science, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NAG 5-19)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0031, UPPER MANTLE HETEROGENEITY - COMPARISON OF REGION SOUTH OF AUSTRALIA WITH THE PHILIPPINE BASIN

C. Brown, Woods Hole Oceanographic Institution, *Main St., Woods Hole, Massachusetts* 02543 (NAG 5-18)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0032, OCEANIC EDDY HEAT AND MOMENTUM FLUXES AT THE CONTINENTAL MARGIN

D.B. Haidvogel, Woods Hole Oceanographic Institution, *Main St., Woods Hole, Massachusetts* 02543 (NAG 5-8)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0033, COMPREHENSIVE RESOURCE INVENTORY AND EVALUATION SYSTEM (CRIES)

R.D. Vlasin, Michigan State University, Agricultural Experiment Station, Dept. of Resource Development, *New Administration Bldg., East Lansing, Michigan* 48823 (0074507; MICL01285H)

OBJECTIVE: Develop an overall analytical framework for assessing agricultural planning options for LDC's. Develop appropriate training materials for transfer of methodologies. Develop technique for creating geographic computer-based information. Develop linear programming models for LDC's. Develop information system for large-area agricultural analysis.

APPROACH: Secure relevant economic data on agricultural sector of LDC's. Develop appropriate data for geographic information system (country-wide). Develop data for agricultural data information system. Obtain land use data (if necessary) from advanced remote sensing technology. Develop analytical model (linear program) for policy analyses. Involve in-country counterparts in all phases of study and training.

PROGRESS: Methods of creating geographic information files developed and tested for resource assessment in developing countries. Installation of geographic information system installed in Dominican Republic, in support of analytical model for assessing national policy issues in agricultural sector. First generation analytical system installed in Dominican Republic. Evaluation of light-aircraft photography for crop stress monitoring begun. Sugar cane rust is object of study in the Dominican Republic. Preliminary findings indicate the color-infrared imagery accurately reflects plant stress; current efforts aimed at isolating and factoring causes of stress (rust infection, drainage, nutrient deficiency, etc.). Operational techniques being developed for this type of monitoring technique. National and cover/use inventory begun in Syria. Data is being assembled in support of analytical model development, similar to work in the Dominican Republic.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, Michigan

5.0034, LAND-USE MAPPING IN DIGITAL FORMAT FROM AIR PHOTOS

C.E. Olson, University of Michigan, Ann Arbor Campus, School of Natural Resources, *Ann Arbor, Michigan* 48104 (0067794; MICY00040-F)

OBJECTIVE: Develop an interactive, digital, storage and retrieval system for land-cover data extracted from air photos. Complete land-cover mapping of Washtenaw Co., Mich., in this digital format.

APPROACH: A one hectare grid based on the UTM coordinate system is used as the matrix for land-cover data. Also included is a four-level expansion of the classification system in USGS Circular 671, and demographic, transportation, and soil permeability data. The classification scheme includes 150 forest classes. All data inputs are based on human interpretation of existing air photos.

PROGRESS: The LIGMALS software package was found to be too inflexible to handle the data retrieval needs of the user community. Needed modifications have been identified. This project has been terminated. Future work will be performed under a different state project.

SUPPORTED BY Michigan State Government

5.0035, REMOTE SENSING OF YIELD OF FOREST PLANTATIONS

C.E. Olson, University of Michigan, Ann Arbor Campus, School of Natural Resources, Fisheries Forestry & Wildlife Program, *Ann Arbor, Michigan* 48104 (0072439; MICY00098-F)

OBJECTIVE: Determine if yield of forest plantations can be determined from remote sensor data; How such remote-sensing data can be economically introduced into managemnet and harvesting decisions.

APPROACH: A review of industrial forest plantation practices will be made in the South (North Carolina, Tennessee, and Texas), Lake States (Michigan), and Pacific Northwest (Washington-Oregon) to determine the critical factors affecting plantation yield. These factors, including initial survival, growth rates, and damage due to insects or disease, will be compared with proven and probable remote sensing capabilities. From this comparison we expect to identify those variables amenable to evaluation through remote sensing techniques. An attempt will be made to develop a regression model that will permit integration of known site data (e.g., soils, precipitation, and temperature) with remote sensor data to predict yield at rotation age, and to refine that prediction as additional data becomes available. We plan to work with the Weyerhaeuser Company and Packaging Corporation of America to identify how best to integrate such yield predictions into operational management processes. Approval of both firms has been obtained.

PROGRESS: Counts of surviving trees in three-year old pine plantations made from 1:200, 1:2400, and 1:3600 scale color and color-IR photographs decreased when the number of trees in the sample plots exceeded 300. Accuracy was greatest for all seven interpreters when plot size was adjusted so that each plot included 100 to 200 possible tree locations.

SUPPORTED BY Michigan State Government

5.0036, FOREST RESOURCE MANAGEMENT APPLICATIONS OF MEDIUM- TO HIGH-ALTITUDE COLOR INFRARED AERIAL PHOTOGRAPH

T.M. Lillesand, University of Minnesota, St. Paul Campus, School of Forestry, McIntire Stennis Program, *301 Green Hall, St. Paul, Minnesota* 55108 (0064373; MIN-42-050)

OBJECTIVE: Improve the efficiency of forest land managers through the determination of the best type and the cost-effectiveness of medium and high altitude infrared color aerial photography for forest resource surveys and forest land management.

APPROACH: A forested area in Northern Minnesota will be photographed using standard forestry aerial photography and various types of smaller scale color infrared aerial photography. Selected forest survey and forest management information needs which can be determined from aerial photographs will be interpreted by locally experienced trained professional forest aerial photo interpreters. The results of the interpretations will be analyzed by statistical means as well as interpreter reaction. At the same time, data on the costs of the two types of aerial photography will be determined. A benefit-cost approach will be used to determine the optimum type of photography for forest survey and management purposes. In addition to the project interpreters, all possible local, on-the-ground, land managers will be given copies of the photography to evaluate in their own terms.

PROGRESS: The preparation of an experimental forest fuel type map of Isle Royale National Park was undertaken using 23x23 cm format 1:15,840 scale color infrared aerial photography. Small format 35mm and 70mm CIR was successfully used to improve classification accuracy in areas with poor quality metric camera coverage. A major effort toward the development of computer image processing capabilities for aerial film (CIR in particular) was initiated: (a) specialized sensitometric equipment was purchased, developed and activated; (b) other available specialized digitizing equipment at U of Minn. was identified and evaluated; (c) initial computer programs were developed and tested; (d) ties with the existing operation at U of Wisc. were established; and (e) transfer of software from Syracuse U and U of Wisc. to U of Minn. were initiated.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, Minnesota

5.0037, FOREST RESOURCE MANAGEMENT APPLICATIONS OF DIGITAL IMAGE PROCESSING

T.M. Lillesand, University of Minnesota, St. Paul Campus, School of Forestry, Dept. of Forest Resources, *301 Green Hall, St. Paul, Minnesota* 55108 (0079696; MIN-42-038)

OBJECTIVE: Determine the need for and form of radiometric calibration of forest resource photography; determine the form and evaluate the utility of digitized photography in forest type mapping and insect and disease assessment; improve, as appropriate, the integration of conventional photointerpretation, densitometric analysis of digitized aerial and space photography, and automated analysis of LANDSAT data for forestry applications; and define the technological form and measure the costs and benefits of merging digital remote sensing procedures with conventional interpretation techniques.

APPROACH: Photograph test area at multiple altitudes using color infrared film under a range of atmospheric conditions. Sensitometrically calibrate photographs and develop model to compensate for atmospheric effects and film processing variations. Digitize photography using a scanning microdensitometer and film processing variations. Digitize photography using type mapping. Perform similar analysis using digital LANDSAT data. In both cases, integrate "manual" interpretation to guide the computer mapping efforts. Assess the benefits of using digitized photographs, LANDSAT data, and conventional interpretation (first separately, then jointly) in terms of forest cover classification accuracy, as measured by field verification. Compare costs of various methodologies.

SUPPORTED BY Minnesota State Government

5.0038, IAFHE REMOTE SENSING LABORATORY

M.P. Meyer, University of Minnesota, St. Paul Campus, School of Forestry, Dept. of Forest Resources, *301 Green Hall, St. Paul, Minnesota* 55108 (0065906; MIN-42-033)

OBJECTIVE: Provide remote sensing applications advice and operational support to the various departments in the institute of Agriculture, Forestry and Home Economic and Agricultural Experiment Station, University of Minnesota.

APPROACH: Within the scope of facilities and personnel available: Provide training in remote sensing applications on an individual, team or group workshop basis; make available all possible remote sensing equipment and instrumention, along with laboratory working space, to interested users; assist in overflight planning, airphoto procurement and image interpretation; provide limited overflight services with small format (35mm, 70mm) single and multipcamera aerial photography; assist in equipment design and operational technique development.

PROGRESS: Completed and published a 35mm aerial photography operational manual. Cooperatively with Dept. of Agr. Engr., a system of color 35mm vertical aerial photography an image analysis was developed and successfully tested for assessing powerline structure impact upon agriculture land use in the Dakotas, Nebraska, Iowa, Minnesota and Wisconsin. A trial series of color and CIR overflights was initiated on Univ. Agr. Expt. Sta. branch stations to determine uses of sequential aerial photography in station management and research.

SUPPORTED BY Minnesota State Government

5.0039, SYSTEMATIZED PROCEDURE FOR MAPPING URBAN LAND USE

B.O. Benn, U.S. Dept. of Defense, Army, Corps of Engineers, Waterways Experiment Station, *P.O. Box 631, Vicksburg, Mississippi 39180 (31584(2))*

OBJECTIVE: The objective of this study is to evaluate the feasibility of mapping urban land use by systematic procedures applied to digital multispectral scanner data. Emphasis will be placed on providing data needed for flood runoff and flood damage assessment calculations. The procedures will allow rapid determination of the areal extent of urban lands and to some extent the types of urban land uses. They will also enable rapid updating of land-use data bases to show changes in land use and the locations and extent of recent urbanization.

APPROACH: A literature search will be conducted to examine previous applications of multispectral scanner data to urban land-use mapping, and to establish through anticipated

users, urban land-use categories pertinent to Corps flood damage assessment and flood plain information needs. Image classification techniques such as those available at NSTL, EROS data center, and major universities will be screened to select those with the most potential for discriminating the desired urban land-use classes based on the spectral and spatial character or urban terrain features. The selected image classification techniques, in conjunction with concepts such as the use of supplemental data, hierarchical classification, and seasonal reflectance variations will be applied to Landsat and thematic mapper type imagery of the Memphis, Tennessee, area. A detailed urban land-use data base recently compiled by the WES will be used to evaluate the performance of the image classification techniques for mapping the desired urban land-use categories. A final report will be prepared to document results of the study and to provide guidance for the use of recommended procedures. This work addresses mission problem statements nos. 2-1-54, 2-1-61, and 2-1-106.

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers, Waterways Experiment Station

5.0040, CHARACTERIZATION OF VEGETATION AND DRAINAGE IN STRIP MINED LANDS UTILIZING REMOTE SENSING TECHNIQUES

C.J. Johannsen, University of Missouri, Columbia Campus, Agricultural Experiment Station, Dept. of Agronomy, *130 Jesse Hall, Columbia, Missouri* 65201 (0071419; MO-684-15-20)

OBJECTIVE: Characterize vegetation and drainage patterns of representative stripped mined areas to evaluate reclamation methods. Extend information to larger areas by remote sensing techniques. Provide information in format usable by reclamation authorities.

APPROACH: Study sites will be selected from three different surface mining stages: Pre-1950, 1950-1972. (Surface mining law passed) and 1972 to present. Study sites will be flown at different seasons of the year to evaluate surface cover. Current photography using four film types plus previous photography will document revegetation success. Random 1000 M(2) quadrants will be ground truthed identifying specie composition and density. Photographs will be digitized and analyzed by computer utilizing pattern recognition techniques. Assessment will be made of vegetation desity. LANDSAT images will also be analyzed over selected areas. Drainage patterns and their influence on reclamation methods will be evaluated. Results will be provided to Extension Service personnel to be utilized in educational programs as well as work by State Reclamation Commission.

PROGRESS: Remote sensing images and data were used to study surface vegetation identification, vegetation biomass and drainage patterns on coal strip mined land in Central Missouri. Methodologies were developed and used for accurate, timely and useful applications of remotely gathered data from monitoring coal surface mining reclamation activities. Vegetation cover was verified at randomly located quadrats on the mine sites. Reference standards were thus established for the analysis and classification for both area metering and digital image methods. Although the computer system is more versatile, both methods are rapid and higly accurate (85-90%). Nine additional mine sites were studied for further comparison of the effects of plant productivity, species diversity and density to the remotely sensed classification. A computer based technique was developed for assessing the extent of reestablished vegetation. Color infrared aerial photographs of the sites were scanned and converted into digital format. Methodology developed offers a reasonable compromise between manual phot interpretation and automatic machine processing strategies for determining vegetative ground cover from remotely sensed data. Aerial photography was also used. (Text Abridged)

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, Missouri

5.0041, CHARACTERIZATION OF PROPERTIES OF STRIP MINE SPOILS AS RELATED TO REMOTE SENSING MEASUREMENTS

C.J. Johannsen, University of Missouri, Columbia Campus, Agricultural Experiment Station, Dept. of Agronomy, *130 Jesse Hall, Columbia, Missouri* 65201 (0073683; MO00354-1)

OBJECTIVE: Characterize the available plant nutrient status of pre-mined overburden layers and the resultant mined spoils determining their necessities for selected plant species. Determine rate and control of pyrite oxidation in overburden layers. Characterize vegetative responses and hydrologic conditions by remote sensing techniques.

APPROACH: Study sites will be selected from three active surface coal mines in Central Missouri. Soil samples will be obtained from the different geologic layers in the high wall cuts. The rate of pyrite oxidation to sulfuric acid at various pH, EL and O(2), also nutrient levels will be determined. The necessity for lime and plant nutrients in reclaiming mined spoil areas will be determined by soil tests and field plot techniques. Vegetative cover and densities will be determined for all plots and check areas. Correlations will be made of vegetative responses with responses measured on color infrared film. Hydrology aspects of vegetative and topographic patterns will be determined from aerial photography. Results will be provided to Extension Service personnel to be utilized in educational programs and to the Missouri Land Reclamation commission for use in their programs.

PROGRESS: Five field research plots have been established in spoil and topsoil conditions on coal strip mined land in two Missouri counties. Soil nutrient status was characterized, incremental soil amendments added and forage and row crops planted. Approximately 500 additional soil samples have been taken for further analysis and comparison. Pre-mined high wall samples were taken to study pH, pyrite oxidation and heavy metal occurrence. Research to determine the exact source of overburden sulfur has been completed and the first years results of subsurface gasses on the plots have been analyzed. Several sets of panchromatic aerial photographs representing a wide range of dates were analyzed for drainage patterns and erosional features. Maps were generated and brought to a common scale. Correlation between remotely sensed data and surface observations were delayed due to poor growing conditions in all plots. Fall reseeding and mulching of forages was accomplished. Mulch has proved to be very important to seed germination and soil moisture retention. The major fertility deficit as noted by soil tests was phosphorus. Acidity also posed a significant threat. (Text Abridged)

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, Missouri

5.0042, INCORPORATION OF LANDSAT TECHNOLOGY INTO FARMERS INFORMATION SYSTEM BEING DEVELOPED BY NASA AND THE MISSOURI FARMERS ASSOCIATION

C.J. Johannsen, University of Missouri, Columbia Campus, School of Agriculture, Dept. of Agronomy, *130 Jesse Hall, Columbia, Missouri* 65201 (NAS13-140)

SUPPORTED BY U.S. National Aeronautics & Space Admin., National Space Technology Lab.

5.0043, LUNAR AND PLANETARY SURFACE DYNAMICS AND EARLY HISTORY

C.M. Hohenberg, Washington University, School of Arts & Sciences, Dept. of Physics, *4559 Scott Ave., St. Louis, Missouri* 63130 (NAG 9-7)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

5.0044, FOREST STAND MAPPING AND EVALUATION ON THE STATE AND PRIVATE LANDS IN MONTANA

F.L. Gerlach, University of Montana, School of Forestry, McIntire Stennis Program, *Missoula, Montana* 59801 (0075184; MONZ07801)

OBJECTIVE: Determine the variability of forest stands delineated from high altitude panchromatic aerial photography. Determine the accuracy with which ground conditions can be correlated to delineate stand classes. Determine the reliability of using the current Montana Forest Survey inventory data for assigning forest resource attributes to delineated stand classes.

APPROACH: Stands will be mapped from 176,000 panchromatic air photos, delineating stand height, canopy cover density, photo tone and texture, topographic exposure, watershed stream order, slope angle and position, and elevation. Random sample points will be selected, visited and measured. Photo and ground data will be compared with Forest survey data.

PROGRESS: A study unit of approximately 29,000 acres was selected, equivalent to the Virginia Peak Quadrangle (USGS 7 1/2 minute topographic series) in Meagher and Park Counties, Montana. Photo-interpretation criteria for stand classifications were developed and applied to high altitude (1:76,000) panchromatic aerial photography. Forest stand delineations annoted directly on film diapositives were mapped using a Kelsh plotter. The resulting map forms an overlay controlled to the Virginia Peak Quadrangle. Fifty-one field samples locations were randomly generated and located on medium altitude color photography. Of the 51 sample locations, 17 were selected randomly for field visitation. At each location, five forest stand sample plots were established. Data were collected on individual tree measurements, general stand characteristics, habitat type phase, and terrian description. A computer processing routine for field work analysis was initiated. A forest stand map of the 29,000 acre Virginia Peak unit has bee completed, and a preliminary assessment made of the variability of the stand classifications. Further field sampling is required to determine the accuracy with which ground conditions can be correlated to the delineated stand classes, and to determine the reliability of using Montana forest survey data for assigning attributes to the delineated stand classes.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, Montana

5.0045, REMOTE SENSING APPLICATIONS FOR THE ANALYSIS AND MANAGEMENT OF RENEWABLE NATURAL RESOURCES

P.T. Tueller, University of Nevada, Reno Campus, Agricultural Experiment Station, Dept. of Renewable Natural Resources, *Reno, Nevada* 89507 (0067967; NEV00614)

OBJECTIVE: Investigate remote sensing techniques for application to natural resources management including range, forestry, wildlife, watershed, outdoor recreation and crop agriculture. Test techniques for vegetation mapping, wetland inventory, range condition and trend, erosion evaluation, and economic value. Assess site biomass and production, land use mapping and classification. Conduct resource inventories and serve as a repository for remote sensing data.

APPROACH: Various scales (1:600 to 1:1,000,000) of color and color infrared film types along with actual ground data, densitometers, and field averaging spectrographs will be used to identify phenomena relative to subjects being investigated. Accepted and experimental techniques and procedures will be used and evaluated. Computerized imagery from Land Set 1 and 11 will be evaluated. In all cases application will be emphasized.

PROGRESS: Large scale 70 mm color aerial photography in stereo pairs has been shown to be a valuable supplementary tool for natural resources studies. At scales between 1:600 and 1:500 we have shown the feasibility for species identification on range and forest sites followed by determination of plant cover, plant density, range condition and trend, plant biomass and erosion, including off-rod vehicle use. At somewhat larger scales (1:5,000-1:15,000) the 70 mm format provides a low-cost medium for mapping range and forest sites. Dichotomous photo interpretation keys for mapping vegetation have been completed and tested for examples or the major plant communities in Nevada. The data is being prepared for publication. Emphasis on the project has now turned to digital analysis of the LANDSAT computer compatible tapes. An interactive software is being acquired for analysis and interpretation of natural resource features, including range condition mapping and range trend monitoring. Algorithmics will be used that allow a combination of both supervised and unsupervised theme extraction.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, Nevada

5.0046, USE OF AIRCRAFT SPECTRORADIOMETRY TO DETERMINE WATER QUALITY

H.L. McKim, U.S. Dept. of Defense, Army, Corps of Engineers, Cold Regions Research & Engineering Lab., *P.O. Box 282, Hanover, New Hampshire* 03755 (31583)

OBJECTIVE: To quantitatively assess water quality parameters in fresh and salt water regimes utilizing aircraft spectroradiometer data and to conduct laboratory tests to determine spectral bands of interest for quantitative and qualitative measurement of water quality data to meet Corps of Engineers requirements.

APPROACH: A prototype 500-channel aircraft spectroradiometer instrument with a 10 Angstrom units spectral resolution will be used in the study to assess water quality parameters in fresh and salt water systems. The instrument provides a digital tape read-out for 500 channels ranging from the visible (0.42 microns) to the near infrared wavelengths (1.0 micron) for a minimal 60 by 60 ft. area. Laboratory testing to determine spectral bands of interest will be conducted with the airborne spectroradiometer instrument. The results will be compared to field tests in FY 78 run. Aircraft spectroradiometer flights over selected test site areas will be accomplished in conjunction with ground truth data acquisition. Analysis of the high resolution multispectral data will be used to qualitatively and quantitatively assess water quality parameters, especially turbidity, based on correlation to field measurements.

In addition, the GISS theoretical model will be run with data taken in 1978. Spectral response curves will be generated based on varying the size, optical properties and density of particulate matter. Results from the 1978 aircraft flight analyses and laboratory experiments will be compared to conventional techniques. A cost-effective comparison between conventional techniques and aircraft spectroradiometry to assess quality parameters in fresh and salt water will be made. Procedures to assess water quality will be made for use by Corps of Engineers Division. District personnel will be developed.

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers, Cold Regions Research & Engineering Lab.

5.0047, REMOTE SENSING APPLICATIONS TO LAND USE AND NATURAL RESOURCES IN NEW HAMPSHIRE

P.E. Bruns, University System of New Hampshire, University of New Hampshire, Inst. of Natural & Environmental Resources, *Pettee Hall, Durham, New Hampshire* 03824 (0067211; NH00232-S)

OBJECTIVE: Develop a master set of stereograms of forest stands and other natural resource features for the 1974 flight of southern New Hampshire, and other readily available imagery that would act as keys for photo interpreters. Develop aerial volume tables in cubic feet for softwood, hardwood and mixed stands with application to timber stands both local and in northern New England generally. Develop methodology for extracting information on long-term forest land use trends for planning purposes based on successive flights (over time) of aerial photography.

APPROACH: Application of aerial photography to recognition and classification of a variety of forest stands and other land features such as agricultural, cultural, forest, geologic and soils; application of aerial photographic measurement to the evaluation of commercial forest stands as to wood volume, diameter class and stand height; test and further develop classification systems for use on successive flights to determine quantitative data on the extent of changes in forest cover and land use.

PROGRESS: Computer printouts with reliable geographic location of forest, wetlands, and the agricultural-open land complex resulted from the work in Dover, New Hampshire, with indication that other signatures can be developed and used to produce output yielding broad land-use classification from LANDSAT data. Digitized high-altitude infrared photography used as input data for the local DEC-10 digital computer yields preliminary output indicating that a typical smaller research installation such as ours should be able to develop land-use signatures from such data that can be used locally on a research basis or on larger systems on a production basis. With software improvement of incorporation of a more sophisticated classifier (in prog-

ress) the current system has potential to produce reliable and more detailed land classification than currently available through LANDSAT. A small format camera system and aerial mount have been acquired. Preliminary results indicate that it may be a practical tool for forest survey, inventory, and monitoring in areas of complex small ownership land holdings.

SUPPORTED BY New Hampshire State Government

5.0048, INTEGRATE REMOTE SENSING AND NATURAL RESOURCE MONITORING IN NEW HAMPSHIRE

P.E. Bruns, University System of New Hampshire, University of New Hampshire, Inst. of Natural & Environmental Resources, *Pettee Hall, Durham, New Hampshire* 03824 (0079163; NH00232)

OBJECTIVE: Improve the monitoring of natural resources in New Hampshire by integrating three types of remote sensing data sources; small format (35 mm) photography, high altitude infrared photography and LANDSAT (satellite) data, into an effective, low cost and universally applicable informational system incorporating the application of automated data processing.

APPROACH: Small format photography will be obtained and used to develop large-scale photo interpretation keys for forest and other natural resource applications. Computer programs and hardware utilizing high altitude infrared photographs (LANDSAT) and magnetic tape (EROS) signatures will be developed and tested on forest and land cover classifications in Dover, New Hampshire. The three systems of remote sensing will be incorporated into a single multisensor multistage sampling procedure and tested to determine if lower cost along with information accuracy can be achieved.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, New Hampshire

5.0049, ASSESSMENT OF GEOPHYSICAL ALGORITHMS AND REGIONAL APPLICATION OF DATA

V.E. Delnore, Rutgers the State University of New Jersey, New Brunswick Campus, Agricultural Experiment Station, Dept. of Meteorology & Physical Oceanography, *Old Queens Bldg., New Brunswick, New Jersey* 08903 (0079114; NJ00280)

OBJECTIVE: Develop remote sensing instruments for measurement of near-surface winds and differentiating of sea-ice types.

APPROACH: Participate in calibration and flight testing of instruments.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, New Jersey

5.0050, RESEARCH RELATIVE TO THE EFFECT OF SUBDUCTION ZONES ON THE LOW-ORDER OF THE GEOID

W.F. Haxby, Columbia University, Lamont Doherty Geological Observatory, *Palisades, New York* 10964 (NAG 5-33)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0051, FINITE ELEMENT RESEARCH OF THE SURFACE STRAIN FIELD ADJACENT TO THE SAN ANDREAS FAULT

D.L. Turcotte, Cornell University, Ithaca Campus, School of Arts & Sciences, Dept. of Geological Sciences, *Ithaca, New York* 14850 (NAG 5-39)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0052, THEORETICAL INVESTIGATION OF THE MECHANICS OF STRIKE SLIP FAULTING IN AN ANELASTIC EARTH

H.J. Melosh, State University of New York, Stony Brook Campus, School of Arts & Sciences, Dept. of Earth & Space Sciences, *Stony Brook, New York* 11790 (NAG 5-7)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0053, MONITORING STREAM SEDIMENT LOADS THROUGH MULTISPECTRAL AERIAL PHOTOGRAPHY

T.M. Lillisand, Syracuse University, State University of NY Col. of Environmental Sci. & Forestry, McIntire Stennis Program, *Syracuse, New York* 13210 (0066319; NYZ-107-0-008)

OBJECTIVE: To develop a multispectral photographic remote sensing system to facilitate measurement of sediment production in forested areas.

APPROACH: Simultaneous acquisition of multiple exposure aerial photographs, in situ reflectance measurements and suspended solids samples will be made. Photographs will be procured with a 4-camera bank of motor-driven 70 mm Hasselblad cameras. Microdensitometric measurements at image point positions associated with each ground sampling point will be extracted from the photography. Models will be developed enabling estimations of sediment concentrations from image density observations. Concentration maps will be generated using electronic image analysis equipment.

PROGRESS: Simultaneous acquisition of aerial photography and water sampling continued into the Fall of 1975. Analysis of water samples was carried on concurrently with sampling. Film analysis was initiated during the water sampling period but only in a 'first look' basis. Further film analysis, method development and statistical testing was carried out. Results indicate a good correlation exists between suspended solids (sediment load) and relative film exposures. The methodology used to monitor stream sediment loads was demonstrated using color aerial photography (Chapin 1976); however, further refinement of the procedures is necessary. Concurrent studies using LANDSAT 1 satellite data were not completed during the reporting period.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, New York

5.0054, ATMOSPHERIC HALOCARBONS

P.L. Hanst, U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab., *Research Triangle Park, North Carolina* 27711 (G603A-AF-004)

OBJECTIVE: Assess the impact of fluorocarbons and other halogenated organics on stratospheric ozone levels; manage and conduct research to characterize the air in various locations, to provide insight into future atmospheric problems.

APPROACH: Combine laboratory experimental measurements, through the use of specialized instrumentation, e.g., long path infrared absorption, with theoretical modeling work; collect samples of halocarbons by aircraft to provide vertical profiles from the earth's surface into the stratosphere.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

5.0055, CHARACTERIZATION OF GASEOUS EMISSIONS FROM STATIONARY SOURCES BY REMOTE SENSING

W.F. Herget, U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab., Emissions Measurement & Characterization Div., Special Techniques Group, *Research Triangle Park, North Carolina* 27711 (G712B-BD-017)

OBJECTIVES: Use ground-based remote sensing methods to determine species identity and concentration of gaseous pollutants emitted by point and extended area stationary sources; determine optimum spectral regions for monitoring specific pollutants.

APPROACH: Longpath high-resolution infrared spectroscopy will be used in absorption and emission to determine the spectral characteristics of gaseous pollutants emitted by a variety of sources. Laboratory spectra of various species will be obtained to assist in species identification and concentration determinations. Long path gas-filter correlation methods will also be used.

CURRENT PLANS/PROGRESS: Measurements using a grating spectrometer have been made at coal-burning power plants, incinerators, gas purification plants and carbon black plants. The grating spectrometer has been replaced with a Four-

ier transform spectrometer to greatly increase spectral resolution and sensitivity. A variety of sources will be studied in future years.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

5.0056, AIRCRAFT TURBINE EMISSION MEASUREMENTS

W.F. Herget, U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab., Emissions Measurement & Characterization Div., Special Techniques Group, *Research Triangle Park, North Carolina* 27711 (G712B-BA-041)

OBJECTIVES: Determine reasons for apparent discrepancy between NO concentrations in jet engine exhausts as determined by non-extractive electrooptical methods and by extractive probe methods.

APPROACH: Several types of non-extractive electrooptical instruments and probe systems will be used to measure NO concentrations in heated cells and in flat-flame burners. Experiments will be conducted to determine which type of measurement gives the most accurate results and to determine the reasons for differences between the results obtained by the different methods.

CURRENT PLANS/PROGRESS: This two-year program is to be jointly funded by the EPA, Navy, NASA, Air Force and FAA, with the FAA acting as the lead agency. A procurement document has been prepared and contract is expected to be awarded during FY 77.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

5.0057, NEOTECTONICS OF PAKISTAN

R.D. Lawrence, Oregon State Higher Education System, Oregon State University, School of Science, Dept. of Geology, *126 Agricultural Hall, Corvallis, Oregon* 97331 (NAG 9-2)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

5.0058, GOES SATELLITE RESEARCH PROJECT, JUNIATA RIVER BASIN, PA.

C.D. Kauffman, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *228 Walnut St., Harrisburg, Pennsylvania* 17108 (PA 76-075)

An automated hydrologic data collection processing system is needed to provide users with processed data which is essentially real time and independent of manually collected data tapes.

To evaluate the Geostationsary Operational Environmental Satellite (GOES) System, determine the reliability of the convertible data collection platform (CDCP) and associated hardware, and demonstrate usefulness of data processing through the system. Select 20 sites for upcoming COMSAT General proposed pilot project and brief cooperators and District personnel on the COMSAT system.

To install CDCP's on water level sensors at nine of 14 gaging stations currently being operated in the basin and attempt to manage the stations based on data coming through the GOES system. Develop viable analysis and processing techniques using GOES-collected data. Meet with COMSAT personnel and cooperators for exchange of information regarding the COMSAT system operational features, site selection, and data format, needs, and availability.

All CDCP's were returned twice for factory modification and installed in the field. Data was monitored almost daily. Six technicians were trained in CDCP operation. An unpublished report on CDCP operation for a one-year period was completed and submitted to the Chief, Data Relay project. Data for five COMSAT DCP's was monitored almost daily for an eight-month period after which DCP's and associated hardware were removed. A performance report was prepared by COMSAT General and a performance summary was prepared by the Chief, Data Relay project.

Continue to evaluate the geostationary operational environmental satellite (GOES) system, determine the relisbility of the convertible data collection platform (CDCP) and associated hardware, and demonstrate usefulness of data processing through the system. Meet with COMSAT personnel and cooperators to select 20 sites for upcoming proposed COMSAT General pilot project. Perform necessary field reconnaissance at each site.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0059, REMOTE SENSING AND MULTISAMPLING IN MONITORING CHANGES IN FOREST CONDITIONS IN THE COASTAL PLAIN

W.A. Shain, Clemson University, Agricultural Experiment Station, Dept. of Forestry, *Long Hall, Clemson, South Carolina* 29631 (0079113; SCZ00051-FR)

OBJECTIVE: Determine the feasibility of utilizing estimates of timber volume on the ground and on aerial photographs to inventory timber volumes from satellite imagery.

APPROACH: One satellite scene of the upper coastal plain of South Carolina (approximately 700,000 acres) comprises the study area. Color infrared aerial photographs will be taken of this area in sample strips. Ground samples will be systematically located and measured in the same area covered by the aerial photos. Using the COMTAL plotter at Georgia Tech, the study area will be delineated into land use types. Those acreages containing timber volume will be correlated to ground volumes to provide a potential timber inventory from satellite imagery.

SUPPORTED BY South Carolina State Government

5.0060, EVALUATION OF DOMESTIC INFORMATION SYSTEM FOR STATE GOVERNMENT APPLICATION

D.J. Cowen, University of South Carolina, School of Arts & Sciences, Dept. of Geography, *Admin. Bldg., Room 115, Columbia, South Carolina* 29208 (NAS13-144)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0061, IRRIGATION MANAGEMENT WITH REMOTE SENSING

J.L. Heilman, South Dakota State University, School of Engineering, Dept. of Agricultural Engineering, *Brookings, South Dakota* 57006 (NAG 5-37)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0062, APPLICATION OF SATELLITE AND AIRCRAFT DATA TO HYDROLOGY

G.K. Moore, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Sioux Falls, South Dakota* (CR 73-196)

Remote sensing has considerable potential for hydrologic studies, particularly in the visible, infrared, and microwave parts of the spectrum. It offers new information and new tools to the hydrologist and can reduce the field work necessary in conventional studies. Research, testing, and development are needed to obtain operational procedures, however.

(1) Conduct research on the applications of remote sensing to ground-water occurrence, surface drainage characteristics, and water color and turbidity. Develop application examples. (2) Develop enhancement and interpretation procedures for remote sensing imagery and digital data, using both manual and computer processing. (3) Train and consult with other hydrologists on feasibility tests and operational uses of remote sensing. (4) Originate, plan, and coordinate programs and projects in remote sensing.

(1) Analyze existing data for hydrologic information; develop procedures for information extraction. Evaluate effects of atmosphere and soil and vegetation cover. (2) Evaluate existing procedures for manual and digital processing. Determine need and utility of new procedures. (3) Conduct training courses and briefings. (4) Work with WRD, EROS, and NASA personnel to originate and coordinate remote sensing applications to hydrologic problems.

Two training courses in Hydrologic Remote Sensing were conducted for WRD personnel; an abbreviated course was given in Tehran, Iran. A formal paper on physical water quality was prepared and given in Manila, Philippines; an informal paper on ground-water exploration was given in Hyderabad, India. Two new training exercises were prepared, and eight training lectures were documented. An informal talk was given to Colorado Water Congress. Training in digital processing was given to two people from one district. Research was begun on the enhancement of current patterns in rivers and estuaries.

Conduct 1-2 training courses in hydrologic remote sensing. Continue research on current patterns in rivers and estuaries and prepare a formal paper on results. Prepare paper summarizing principles of remote sensing for ground-water exploration. Begin research on relationship of source areas to streamflows. Document additional training lectures.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0063, REMOTE SENSING TECHNIQUES FOR WATER RESOURCE PREDICTION AND MANAGEMENT
B.J. Blanchard, Texas A & M University, College Station Campus, Agricultural Experiment Station, Dept. of Agricultural Engineering, *College Station, Texas* 77843 (0072159; TEX06252)

OBJECTIVE: Select and evaluate appropriate remote sensing devices and techniques for use in measuring watershed parameters associated with watershed runoff prediction models. Develop improved watershed runoff models based on remote sensing measurements.

APPROACH: Existing and newly developed systems in remote sensing will be studied to determine the applicability of each system for measuring or mapping either single parameters, such as soil moisture, land use, etc. or combined parameters represented by watershed runoff coefficients. Results of these tests will be used to develop watershed runoff models using remote sensing data as input. The new models will then be tested on measured watersheds to demonstrate their applicability.

PROGRESS: Data have been collected to develop multivariate spectral prediction schemes for measurement of soil moisture and vegetative cover using visible, infrared, thermal and microwave sensors. Other ground data sets were collected to correlate soil moisture and watershed runoff coefficients with microwave data from the SEASAT SAR imaging radar (1.6 gHz frequency). Techniques developed in 1977 for estimation of an antecedent precipitation index by use of the Nimbus 5 passive microwave system (ESMR) are being tested on a large region of the southern grain plains. Results from this test for a three-year time period are anticipated within six months. Results from an experiment using active microwave systems repeatedly over six fields where soil moisture was measured showed that a time series of soil moisture in the near surface soils can be obtained with airborne active microwave. Data from this experiment are now being studied to define the improvement in estimation that can be obtained by using two wavelengths in the microwave region to estimate soil moisture. Lysimeter measurements have been made to establish a basis for development of a soil moisture model that will use only remotely sensed data as input.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, Texas

5.0064, INVESTIGATION OF REMOTE SENSING TECHNIQUES FOR MEASURING SOIL MOISTURE
R.W. Newton, Texas A & M University, College Station Campus, School of Agriculture, Dept. of Plant & Soil Science, *College Station, Texas* 77843 (NAG 5-31)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0065, REMOTE SENSING IN AGRICULTURE
N.L. Powell, Virginia Polytechnic Inst. & State University, School of Agricultural & Life Sciences, Dept. of Agronomy, *Blacksburg, Virginia* 24061 (0065075; VA-0312724)

OBJECTIVE: Use multi-spectral sensing techniques identify plant canopies of various stages of development, determine plant vigor, evaluate plant communities for effects of plant stress, determine the optimum wavelength regions for specific signatures of crop and soil conditions, utilize data processing devices, including computer software, analyze data and provide appropriate maps and other results, develop a system of remote sensing useful for agriculture.

APPROACH: Utilizing aerial platforms, remote sensing overflights with camera and multi-band sensor systems will be conducted on controlled agricultural experiment stations and farms in the Chesapeake Bay region. Detailed ground truth data of soil and crop parameters will be correlated with the multispectral imagery.

PROGRESS: The system design and implementation of an automatic agricultural weather data collection network was completed. Information obtained from this network will be used to develop crops management models for the major agronomic crops of Virginia. Planting dates, irrigation, pest control, harvest dates, etc. are types of management decisions to be included in the models. Aerial flights were conducted over the peanut growing region to monitor the development and spread of Cylindrocladium black rot (CBR) and Sclerotinia blight (SB) in peanut fields. Results of imagery analysis indicate that CBR caused a minimum problem for peanut growers while SB caused significant yield reductions in some fields.

SUPPORTED BY Virginia State Government

5.0066, REMOTE SENSING APPLICATIONS TO LAND RESOURCE INVENTORY
B.E. Frazier, Washington State University, College of Agriculture, Dept. of Agronomy & Soils, *Pullman, Washington* 99163 (0070070; WNP00323)

OBJECTIVE: Determine suitability of LANDSAT-based information for land resource inventories. Develop subclasses to the Anderson land use classification that have utility as a data base for local planners. Evaluate other remote sensing systems and techniques for potential application to land resource studies as they become available.

APPROACH: An investigation of LANDSAT-based information products for rural land use applications will be conducted using Whatcom Co. data. Functional subclasses of the Anderson system will be devised. Photo interpretation and satellite imagery interpretation techniques will be developed to isolate required categories. Evaluate new systems as they become available for public use i.e., remote sensing instruments, e.g., thermal energy detectors developed for military use.

PROGRESS: Investigation of aerial photography as a means of documenting sediment source areas and management practices has shown that implement patterns from chisel plowing, harrowing, drilling and combining were visible with the unaided eye. Furrow spacing was measurable in all cases except with harrowing photographed at 1/8000 scale. The predoeninant erosion feature, (rills) were visible at all scales with the unaided eye. More were seen on 1/2000 scale images than on any other scale. Minimum rill widths of 38 mm were measured on 1/2000 scale CIR images of bare soil with a 50X pocket microscope. Larger widths were necessary to measure rills at smaller scales. Best results determining rill density were obtained with a zoom stereoscope. Eighty-five percent of those seen on ground photos were counted on CIR aerial photos at 1/2000 scale. A proposal has been written to investigate the relationships between rill patterns seen on aerial photographs and sediment yield. Appointment to NASA sponsored Remote Sensing Science Council was accepted and a joint meeting with the Conference of Remote Sensing Educators was attended. The International Soil Science Society Congress was attended.

SUPPORTED BY Washington State Government

5.0067, ANALYSIS OF THREE-DIMENSIONAL THUNDERSTORM MODEL OUTPUT IN TERMS OF GEOSYNCHRONOUS SATELLITE OBSERVATIONS
R.E. Schlesinger, University of Wisconsin, Madison Campus, Graduate School, *500 Lincoln Dr., Madison, Wisconsin* 53706 (NAG 5-23)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0068, COMPUTER-AIDED IDENTIFICATION & CLASSIFICATION OF VEGETATION ON THE APOSTLE ISLANDS USING REMOTE SENSING
T.M. Bonnicksen, University of Wisconsin, Madison Campus, School of Natural Resources, Dept. of Forestry, *Agriculture Hall, Madison, Wisconsin* 53706 (0079658; WIS02438)

OBJECTIVE: Identify, classify and digitally map, using a scanning densitometer and associated computer software, the vegetation cover-states on Bear and surrounding Islands from a 1:120,00 color I.R. transparency. Determine the accuracy of the digital vegetation cover-state maps by comparing the digital map for Bear Island with a hand drawn map that is verified with ground data. Evaluate the potential of using computer-aided vegetation mapping techniques for the management of vegetation in national parks and reserves.

APPROACH: A NASA (RB-57F) high altitude (small scale) 1:120,000 false-color infrared transparency of the Apostle Islands has been scanned at 50 mu intervals in each of four wavelength bands. Digitized data on spectral reflectance values obtained by scanning were processed with computer programs designed to classify these values using a modified clustering technique. The accuracy of the digital display map will be determined by comparing it with the hand drawn map of vegetation cover-states on Bear Island.

SUPPORTED BY Wisconsin State Government

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, LIFE SCIENCE FLIGHT EXPERIMENT - PULMONARY BLOOD FLOW
D.M. Wiberg, University of California, Los Angeles Campus, School of Engineering & Applied Science, Dept. of System Science, *405 Hilgard Ave., Los Angeles, California* 90024 (NAS 9-16047)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0002, THERMOREGULATION IN PRIMATES IN THE SPACE ENVIRONMENT, EXPERIMENT NO. 781-039
C.A. Fuller, University of California, Riverside Campus, School of Natural & Agricultural Sciences, Dept. of Biology, *Riverside, California* 92502 (NAS 2-10536)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0003, TISSUE FLUID SHIFTS AND MUSCLE FUNCTION IN HUMANS DURING WEIGHTLESSNESS
A.R. Hargens, University of California, San Diego Campus, School of Medicine, Dept. of Surgery, *P.O. Box 109, La Jolla, California* 92093 (NAS 9-16039)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0004, EFFECT OF WEIGHTLESSNESS ON THE FLUID PHYSIOLOGY OF THE INNER EAR
A.F. Ryan, University of California, San Diego Campus, School of Medicine, Dept. of Surgery, *P.O. Box 109, La Jolla, California* 92093 (NAS 9-16033)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0005, LIFE SCIENCE FLIGHT EXPERIMENT - PULMONARY FUNCTION DURING WEIGHTLESSNESS
J.B. West, University of California, San Diego Campus, School of Medicine, Dept. of Medicine, *P.O. Box 109, La Jolla, California* 92093 (NAS 9-16037)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0006, LIFE SCIENCE FLIGHT EXPERIMENT - INSULIN AND GLUCOSE METABOLISM IN MAN
D.L. Searle, University of California, San Francisco Campus, Graduate School, *551 Parnassus Ave., San Francisco, California* 94122 (NAS 9-16038)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0007, HUMAN 1, 25 DIHYDROXY VITAMIN D3 CALCITONIN & PARATHORMONE LEVELS DURING THE DEVELOPMENT OF OSTEOPOROSIS (ABBREV)
C. Arnaud, University of California, San Francisco Campus, School of Medicine, Dept. of Medicine, *551 Parnassus Ave., San Francisco, California* 94122 (NAS 9-16027)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0008, LIFE SCIENCE FLIGHT EXPERIMENT - SURFACE CHEM BUBBLE FORMATION
J.F. D'Arrigo, University of Hawaii System, Manoa Campus, John A. Burns School of Medicine, Dept. of Physiology, *2444 Dole St., Pacific Biomedical Res. Ctr., Honolulu, Hawaii* 96822 (NAS 9-16048)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0009, LIFE SCIENCE EXPERIMENT - RESPONSE TO MYOTATIC REFLEX
G.L. Gottlieb, Rush University, College of Health Sciences, Dept. of Physiology, *Chicago, Illinois* 60612 (NAS 9-16035)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0010, INFLUENCES OF MECHANICAL VIBRATION OF PLANT GROWTH AND DEVELOPMENT UNDER HYPOGRAVITY CONDITIONS
C.A. Mitchell, Purdue University, School of Agriculture, Dept. of Horticulture, *Life Sciences Bldg., West Lafayette, Indiana* 47907 (NAS 2-10514)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0011, LIFE SCIENCE FLIGHT EXPERIMENT
P.K. Bhagat, University of Kentucky, School of Engineering, Dept. of Mechanical Engineering, *Limestone & Euclid, Lexington, Kentucky* 40506 (NAS 9-16034)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0012, CLINICAL OPHTHALMIC ULTRASOUND IMPROVEMENTS
P.A. Piro, Johns Hopkins University, School of Medicine, Dept. of Ophthalmology, *725 N. Wolfe St., Baltimore, Maryland* 21205 (NAS 5-26085)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

6.0013, LIFE SCIENCE FLIGHT EXPERIMENT
W.G. Walker, Johns Hopkins University, School of Medicine, Dept. of Medicine, *725 N. Wolfe St., Baltimore, Maryland* 21205 (NAS 9-16030)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0014, FLUID AND ELECTROLYTE HOMOSTASIS DURING SPACEFLIGHT (ELUCIDATION OF MECHANISMS IN A PRIMATE)
M.C. Moore Ede, Harvard University, Boston Campus, School of Medicine, Dept. of Physiology, *25 Shattuck St., Boston, Massachusetts* 02115 (NAS 2-10547)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0015, EVALUATION OF ENGINEERED FOODS FOR CELSS (CLOSED ECOLOGICAL LIFE SUPPORT SYSTEM)
M. Karel, Massachusetts Inst. of Technology, School of Science, Dept. of Nutrition & Food Science, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NAS 9-16008)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0016, FEBRILE RESPONSES DURING SPACEFLIGHT, EXPERIMENT NO. 781-242
M.I. Kluger, University of Michigan, Ann Arbor Campus, Medical School, Dept. of Physiology, *1335 E. Catherine St., Ann Arbor, Michigan* 48104 (NAS 2-10534)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0017, STUDY OF EFFECTS ON SPACE TRAVEL ON MAMMALIAN GRAVITY RECEPTORS, EXPERIMENT NO. 781-238
M. Ross, University of Michigan, Ann Arbor Campus, Medical School, Dept. of Anatomy, *1335 E. Catherine St., Ann Arbor, Michigan* 48104 (NAS 2-10535)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0018, LIFE SCIENCE FLIGHT EXPERIMENT - IN-FLIGHT STUDY OF CARDIOVASCULAR DECONDITIONING DEFINITION PHASE
L. Farhi, State University of New York, Albany Campus, Graduate School, *1400 Washington Ave., Albany, New York* 12203 (NAS 9-16042)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0019, APPLICATION OF THE AUTOMATIC DATA ACQUISITION AND CONTROL SYSTEMS TO BIOMEDICAL EXPERIMENTS
P.R. Jahnz, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF325480)

The Aerospace Medical Research Laboratory is responsible for definition of human acceleration exposure limits and body kinematic response properties which are required for development of aircraft emergency escape systems and impact protection equipment such as body restraints and energy attenuating devices. This effort includes test and evaluation of new protective systems developed by the Aeronautical Systems Division. These requirements have led to the development of complex experimental facilities, instrumentation and analytical techniques necessary to accomplish experimentation with volunteer subjects and their surrogates. An automatic data acquisition and control system (ADACS) has been developed (work unit 72311613) to provide rapid data collection, analysis, and to achieve the degree of experimental control required when human subjects are used. The objective of this work unit is to adapt and extend the capabilities of the ADACS to meet the unique requirements associated with specific facility control development efforts and new data analysis approaches.

The approach will be 1. Develop control software to assure that human subjects will not be exposed to unintentionally high acceleration, 2. Perform the necessary hardware interfacing to new equipment to complement the control system, 3. Optimize the signal to noise ratio through appropriate analog and digital filtering, 4. Adapt optimal estimation state space analysis to biodynamic experiments and 5. document the results of the effort. An understanding of unique AMRL impact experimentation technology is necessary for this effort, thus, making an in-house approach cost effective.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0020, LDF-79-8 BRAIN OXYGEN MOD AND SUBJECTS (LDF 79-8)
A.T. Kissen, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF325410)

To identify and evaluate the relationship between retinal function (as demonstrated by the electroretinogram) and brain tissue oxygenation under conditions of hypoxic hypoxia and acceleration in the nonhuman primate.

The study will be accomplished in two phases. In Phase I we intend to accomplish a static test validation of novel and newly acquired ERG electrodes in the rhesus monkey. Either by use of an altitude chamber or manipulation of breathing gas mixtures, the animals will be exposed to a hypoxic hypoxia condition and the electroretinogram will be analyzed to establish the precise nature of the response to cerebral anoxia. Phase II will provide brain tissue, p02 and (previously undocumented) electroretinogram data obtained from the fully conscious nonhuman primate exposed to acceleration. The approach described will provide a basis for establishing the agreement or difference in the response of histogenetically related tissue to an environmental stress. The funding for this work unit will be placed in work unit 68930433 (contract F33615-79-C-0050, contractor, SRL).

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0021, MODELS FOR INJURY MECHANISMS AND CRITERIA DEVELOPMENT
R.R. Rasmussen, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF325080)

Several mathematical/computer models have been developed or assembled for the predictive analysis of human body response to various mechanical stresses typically encountered in flight operations. While the dynamic response predictive capabilities of these models have been demonstrated, their application to the prediction of injury has not been adequately exploited. This effort seeks to develop injury prediction capabilities for these models based on the dynamic response predictions of the models and failure criteria gathered from experimental and accident data.

The head-spine, articulated total body and thoracic dynamics models currently being used by the biodynamics and bioengineering division will be the primary models applied to this effort. Injury mechanisms identified from Air Force flight operation cases and consistent with current or potential model response outputs will be analytically described and appropriate computer algorithms prepared and incorporated into the main model structures. Injury or failure criteria for each mechanism will be statistically compiled and used as input to the modified models to allow prediction of probability of injury for a specified dynamic event. Structures of primary concern in this effort are the head-spine complex, the thorax and the long-bone joints of the body.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0022, EFFECTS OF VARIOUS ACOUSTIC EXPOSURES ON HUMAN AUDITORY PROCESSES
M.R. Stephenson, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF325090)

The objective of this work unit is to identify responses of the human auditory system to various acoustic stimuli. The stimuli include (a) long duration (8 hours or greater) exposures to continuous, intermittent and impulse noise, (b) communica-

tion signals during ground or inflight conditions and (c) any additional acoustic signal for which there arises an operational requirement to define its effects on man's auditory system. Once responses to various stimuli are defined, the results will be used to quantify the hearing damage risk and/or their effect on man's ability to communicate in the subject noise environment. This effort will benefit the SG, ASD Life Support SPO, base safety and medical personnel, and the US EPA.

The approach will involve (a) laboratory measurements of acoustic signals under AF communication devices, (b) field measurements under AF communication devices and (c) exposure of human subjects under laboratory conditions to various acoustic signals. Data will be analyzed in the laboratory to identify operational situations with hearing damage risk potential, factors contributing to the problem and possible remedies. This is a consolidation and coordination of effort previously accomplished under work units 72310802, 72310803, and 72310806. semiannual review was accomplished 30 Sep 78 in conjunction with the preparation of the technical management review.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0023, HEARING PROTECTOR EVALUATION PERFORMANCE AND METHODOLOGY
M.R. Stephenson, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF325100)

AMRL/BBA is responsible for evaluating personal hearing protectors, helmets, ground communication headsets and inflight communication headsets for use in AF hazardous noise environments. The objective of this work unit is to (a) maintain an ongoing program of investigating hearing protection performance of the above mentioned devices and (b) maintain current methodological procedures and evaluate potential methodologies for determining hearing protector effectiveness, to comply with current AF and national standards for sound attenuation measurements.

Human subjects will be employed in the laboratory evaluation of a hearing protector's sound attenuation characteristics as measured by the American National Standard Institute (ANSI) real ear attenuation at threshold (REAT) method. Hearing protectors submitted to determine their acceptability or suitability as devices meriting inclusion on the AF qualified products list (QPL) will be evaluated in accordance with the requirements of MIL SPEC 38268B. Results of these and other evaluations will be used to formulate recommendations to the Office of the AF Surgeon General concerning potential application for widespread or special purpose AF use. Data will be processed and prepared in formats consistent with general methods used by the scientific community as well as the AF for estimation of noise reduction in operational situations. Should the methodology for evaluating hearing protectors change, or should the requirements specified for AF evaluations be modified, then appropriate experimental analyses will be accomplished to evaluate and implement the most suitable procedure. This work unit is a consolidation of effort from work units 72310804 and 72310805, for purposes of increased management effectiveness, and does not constitute a new research effort. Semiannual review was accomplished 30 Sep 78 in conjunction with the preparation of the TMR.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0024, LIFE SCIENCE EXPERIMENT
D.E. Herron, University of Akron, Graduate School, *302 E. Buchtel Ave., Akron, Ohio* 44304 (NAS 9-16043)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0025, LIFE SCIENCE FLIGHT EXPERIMENT - ISOMETRIC EXERCISE PERFORMANCE UNDER ZERO-GRAVITY CONDITIONS - DEFINITION PHASE
J.S. Petrofsky, Wright State University, School of Medicine, Dept. of Physiology, *Colonel Glenn Hwy., Dayton, Ohio* 45431 (NAS 9-16041)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0026, CARDIOVASCULAR DECONDITIONING WITH BIOCHEMICAL & HISTOLOGICAL INDICES OF MUSCLE FUNCTION FOLLOWING ZERO-GRAVITY EXPOSURE (ABBREV)
R.T. Dowell, University of Oklahoma, Health Science Center, School of Medicine, Dept. of Physiology & Biophysics, *Box 26901, Oklahoma City, Oklahoma* 73190 (NAS 2-10529)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0027, LIFE SCIENCE FLIGHT EXPERIMENT - PROTEIN METABOLISM
T.P. Stein, University of Pennsylvania, School of Medicine, Dept. of Surgery, *36th & Hamilton Walk, Philadelphia, Pennsylvania* 19174 (NAS 9-16031)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0028, LIFE SCIENCE FLIGHT EXPERIMENT
B.S. Chriswell, Baylor College of Medicine, School of Medicine, *1200 Moursund Ave., Houston, Texas* 77025 (NAS 9-16029)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0029, LIFE SCIENCE FLIGHT EXPERIMENT
R.R. Martin, Baylor College of Medicine, School of Medicine, Dept. of Medicine, *1200 Moursund Ave., Houston, Texas* 77025 (NAS 9-16040)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0030, REGIONAL COOLING
S.A. Nunneley, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF325130)

The project will explore the physiological advantages and limitations of regional cooling, particularly the head and thorax. These areas were selected because they (1) allow practical garment integration, (2) represent 33 percent of body surface area (3) are resistant to cold-induced vasconstriction, and (4) are subject to solar heating in the cockpit. A possibility that requires examination is that head or neck cooling may produce paradoxical effects with the body shutting down its defenses against heat.

The effects of regional cooling will be evaluated using a computer model to select critical combinations of metabolic rate and external environment, then validating the predictions by means of tests on human subjects.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0031, UPGRADED INFLIGHT PHYSIOLOGICAL/ENVIRONMENTAL DATA ACQUISITION SYSTEM
D.G. Powell, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF324510)

Current Air Force flying operations expose aircrew members to stressful and potentially hazardous environments. To build a data base on these environmental conditions and correlate them with physiological responses, it is desirable to develop instrumentation capable of collecting these data during actual inflight conditions. It is necessary to develop a total system which

will take the data from the collection point all the way through limited field processing to detailed laboratory processing, analyses, and plotting.

This work unit is established to coordinate with the U.S. Navy Pacific Missile Test Center in their development of a combination inflight physiological data acquisition system and miniature environmental monitor (IFPDAS/MEM), as well as associated data reduction systems, sensor systems, and software development. The work unit includes previously separate work units 7930-10-11 (upgraded IFPDAS) and 7930-10-12 (upgraded MEM). The IFPDAS/MEM will be a micro-circuited, battery-operated, man- or console-mounted data collection device which records analog and digital data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0032, BIOCHEMICAL EVALUATION OF CARDIAC STRESS RESULTS FROM ACCELERATION

R.J. Reyes, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF324520)

Appraisal of the physiologic 'cost' of stress from acceleration (plus gz), while highly desirable, is technically difficult. Where there is much to indicate that a plus gz resulting from high performance aircraft impose physiologic loads on the flyer, quantitative evaluation needs to be further elucidated.

Post plus gz biochemical evaluation appears to be promising. A urinary battery of determinations (catecholamines, 17-hydroxysteroids, various electrolytes and certain nitrogenous metabolites) will be measured which relate to autonomic, endocrine and metabolic activities. These studies will ultimately lead to plasma analysis of these constitutents which may result in a more immediate qualitation of stress.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0033, LIFE SCIENCE FLIGHT EXPERIMENT - CARDIOVASCULAR ADAPTATION

C.G. Blomquist, University of Texas, Health Science Center at Dallas, Southwestern Medical School, Dept. of Internal Medicine, *5323 Harry Hines Blvd., Dallas, Texas* 75230 (NAS 9-16044)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, NUMERICAL DIFFERENTIATION AND INTERPOLATION PROCEDURE WITH ERROR ESTIMATES FOR NON-EXACT DATA

R.E. Bozeman, Morehouse College, School of Arts & Sciences, Dept. of Mathematics, *223 Chestnut St. S.W., Atlanta, Georgia 30314 (NAG 8-3)*

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

7.0002, RETURN ON AUTOMATIC DATA PROCESSING INVESTMENT

L. Roquemore, Southern University Agricultural & Mechanical College, Baton Rouge Campus, College of Sciences, Dept. of Computer Science, *Southern Branch P.O. Box 9674, Baton Rouge, Louisiana* 70813 (NASW 3344)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Management Operations

7.0003, RESEARCH IN PROBLEM SOLVING SYSTEMS

J. Minker, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Computer Science, *College Park, Maryland* 20742 (NAG 1-51)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

7.0004, DOMESTIC INFORMATION DISPLAY SYSTEM - CONCEPT STUDY

E. Teicholz, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Mathematics, *Cambridge Station, Cambridge, Massachusetts* 02138 (NAS 5-25989)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

7.0005, NUMERICAL METHODS FOR PHASE PLANE PROBLEMS IN ORDINARY DIFFERENTIAL EQUATIONS

R.J. McLeod, New Mexico State University, Las Cruces Campus, School of Arts & Sciences, Dept. of Mathematics, *University Park, Las Cruces, New Mexico* 88003 (NAG 2-23)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, SHORT-RANGE ORDERING STUDIES USING SCANNING TRANSMISSION ELECTRON MICROSCOPY

J.M. Cowley, Arizona State University, School of Liberal Arts, Dept. of Physics, *Tempe, Arizona 85281 (DMR77-21843)*

A high resolution scanning transmission electron microscope (STEM) will be used for the study of short-range ordering of atoms in nonstoichiometric oxides and sulfides and in various amorphous materials. Modifications of the instrument and the addition of new systems for data collection will also be undertaken to further enhance its capabilities. For some nonstoichiometric oxides and sulfides which show tendencies for the formation of superlattices having very large periodicities, the nature of the atomic disorder and the origins of the ordering energies will be sought in terms of local perturbations of the crystal structure and local strain fields. For amorphous semiconductors and glasses the form of the local atomic clusters will be studied.

Developments of the theory of STEM imaging of crystals and computing methods for determining intensity distributions in images and electron diffraction patterns will accompany the experimental observations and investigations will be made of the statistics of atom correlations in two-dimensional projections of limited three-dimensional distributions.

This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0002, LOW-TEMPERATURE RESEARCH IN LIQUID HELIUM

R.E. Packard, University of California, Berkeley Campus, School of Letters & Science, Dept. of Physics, *Berkeley, California 94720 (DMR76-82934 A01)*

Research done under this grant will be a continuation of research begun under NSF Grant No. DMR73-02461. The work involves two main projects: vortex photography and ultralow-temperature research on 3He. A technique has been developed to photographically record the positions of quantized vortex lines in superfluid helium. Both the dynamics of vortex motion and the equilibrium distribution will be studied. The 3He work is done in a nuclear demagnetization refrigerator. Experiments

to study the flow properties and magnetic relaxation properties of the low-temperature phases of 3He will be performed.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0003, REACTION KINETICS OVER SURFACES OF SOLIDS

H. Suhl, University of California, San Diego Campus, Graduate School, Dept. of Physics, *P.O. Box 109, La Jolla, California* 92037 (DMR77-24957)

This research was previously supported by DMR-7624178.

The characterization of simple surface reactions in terms of solid-state parameters will be extended to the cases in which phonons provide the principal energy exchange mechanism. Also, the so-called transmission coefficient of absolute rate theory will be expressed in terms of substrate response functions. A study of adsorption equilibria in relation to substrate properties is to be carried out with a view to separating out substrate effects on the partition function of the activated complex from substrate effects on the pre-exponential factor. A study is to be made of the possibilities for inducing oscillatory reactions over surfaces at will, by coupling to transport phenomena in the substrate. Under previous grants, magneto-catalytic anomalies were explained and a particular one, the initial anomalous oxidation rate of nickel near its Curie point, was both calculated and observed. Under the present grant it is planned to determine if the anomaly can be used as an indicator for studying the details of more advanced stages of the oxidation process. Also, it is planned to attack some long-standing mysteries in catalysis, for example the compensation effect, the extreme sensitivity of certain reactions to rather small applied magnetic fields, anomalous behavior of transport coefficients as a function of adsorbate, etc. Also, coupling between substrate transport properties and adsorbates are to be examined for possible technological uses.

First year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0004, ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF LIQUID DOUBLE DROP DYNAMICS - PRELIMINARY DESIGN FOR SPACE SHUTTLE EXPERIMENTS

J.P. Vanyo, University of California, Santa Barbara Campus, School of Engineering, Dept. of Mechanical & Environmental Engineering, *Santa Barbara, California* 93106 (NAG 2-27)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

8.0005, LASER HOLOGRAPHIC INTERFEROMETRY FOR AERODYNAMICS

R.L. Perry, University of the Pacific, School of Liberal Arts, Dept. of Physics, *3601 Pacific, Stockton, California* 95204 (NCA 2-588001)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

8.0006, ATOMIC HYDROGEN ROCKET ENGINE

R.D. Etters, Colorado State University, School of Natural Sciences, Dept. of Physics, *Fort Collins, Colorado* 80523 (NAG 3-34)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

8.0007, DYNAMICS OF MOLECULES IN CRYSTALS AND ON SURFACES

N.S. Gillis, Colorado State University, School of Science, Dept. of Physics, *Fort Collins, Colorado* 80523 (DMR76-18738 A01)

Research previously supported by DMR76-18738.

Theoretical research in condensed matter physics will be carried out. The main thrust of the work will be in the areas of the dynamics of motion of molecules in crystals and on surfaces. This will involve an investigation of the rotational excitations of molecules in these environments as well as the coupling of the rotational molecular motions with one another and with other degrees of freedom of these systems, such as phonons. Two specific areas will be studied: (1) Structural phase transitions in molecular solids, particularly the family of the inorganic azides. (2) Rotational motion of substitutional impurities of molecular nitrogen in rare gas matrices.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0008, DYNAMICS OF LIQUID STRUCTURE

T.A. Litovitz, Catholic University of America, School of Arts & Sciences, Dept. of Physics, *620 Michigan Ave. N.E., Washington, District of Columbia* 20017 (DMR77-14555 A01)

This systematic investigation is aimed at discovering the nature of the elementary processes that govern translational molecular motions and structural dynamics in relatively simple liquids. The basic approach is to take advantage of the time-dependent information about the relative motion of molecules that can be inferred from the interaction-induced components of the infrared absorption and depolarized Rayleigh scattering spectra, and from molecular dynamics computer simulation experiments. Molecular dynamics computations are used to 'calibrate' each experiment by performing them on a model system whose dynamics are known. Time correlation functions of quantities that depend on interparticle separations are investigated rather than just molecular positions. In this way one expects to be able to isolate a new facet of the dynamics of structural breakup in liquids which is revealed when one looks at the motion of the particles from the reference frame of their drifting environments rather than from a laboratory-fixed viewpoint.

This is a continuation of research supported under DMR 76-17514. First year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0009, TWO PHOTON EXCITATION AS A TOOL FOR ATMOSPHERIC AND KINETIC INVESTIGATION

J.B. Halpern, Howard University, Graduate School of Arts & Sciences, Dept. of Physics, *2400 6th St. N.W., Washington, District of Columbia* 20001 (NAG 5-17)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

8.0010, OPTICAL PROPERTIES OF SOLIDS

L.L. Chase, Indiana University, Bloomington Campus, School of Arts & Sciences, Dept. of Physics, *Memorial Hall, Bloomington, Indiana* 47401 (DMR78-09426)

Experimental investigations of light scattering and laser spectroscopy of solids previously supported by NSF grant DMR-7609091 will continue. The studies will concentrate on the two problem areas: (1) Impurity-induced Raman scattering measurements of coupled electronic and vibrational excitations for impurities with degenerate, or nearly degenerate, ground states; (2) Two-photon absorption and induced absorption studied of excitons and exciton interactions in wide band-gap semiconductors. In addition, light scattering studies of impurity-induced ferroelectric phase transitions in KTaO3, primarily at low impurity concentrations will be initiated. These studies of optical scattering in solids using laser radiation are directed toward providing an improved understanding of electronic and vibrational dynamical effects in insulators and wide band gap semiconductors.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0011, TURBULENCE IN TRANSIENT SOLAR PHENOMENA

M.A. Cross, Grambling State University, School of Arts & Sciences, Dept. of Physics, *Grambling, Louisiana* 71245 (NAG 8-2)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

8.0012, CRYSTAL STRUCTURE AND CATALYTIC PROPERTIES OF NOBLE METAL-RARE EARTH ALLOYS

W.E. Collier, Southern University Agricultural & Mechanical College, Baton Rouge Campus, College of Sciences, Dept. of Physics, *Southern Branch P.O. Box 9674, Baton Rouge, Louisiana* 70813 (NAG 8-4)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

8.0013, SURFACE REFLECTION SPECTROSCOPY

H.D. Drew, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics, *College Park, Maryland* 20742 (DMR79-09064)

Optical spectroscopy can give useful and sometimes unique information about the electronic structure of interfaces. Surface reflectance spectroscopy can be applied to such practically important cases as the solid-electrolyte interface and the solid-gas phase interface. These cannot be probed by the powerful electron spectroscopies (such as ultraviolet photoemission spectroscopy) which require high vacuum. Changes in reflectance due to the addition of monolayer films, however, are very small and difficult to measure. Moreover, the classical interpretation of the data in terms of a uniform thin layer with a characteristic dielectric function has been questioned. In previous work a sensitive difference spectrometer was developed that is suitable for scanning measurements over the spectral range from 0.1-11 eV using a rotating sample configuration. Theoretical expressions were derived relating the changes in reflectance to certain averages of the dielectric function of the system.

In the present grant period, well characterized systems such as hydrogen and xenon on tungsten (100) are being studied. The results are being compared with those from the electron spectroscopies. Theoretical investigations are made into the electrodynamics of the vacuum-metal interface and the electronic structure of chemisorbed layers. In particular, the effects of local field corrections on the optical properties of the interface are being examined.

Renewal of work supported by DMR76-82128.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0014, STATISTICAL MECHANICS AND THE MANY-BODY PROBLEM

F.Y. Wu, Northeastern University, College of Arts & Sciences, Dept. of Physics, *360 Huntington Ave., Boston, Massachusetts* 02115 (DMR78-18808)

Research previously supported under DMR7620643.

The phenomena of order-disorder transition through the consideration of model systems in lattice statistics will be investigated. Specific problems proposed for study include the percolation process, the Ashkin-Teller and the Potts models, phase transition in HC, a two-layer Ising system, and exact renormalization group transformation for the Ising model. Emphases will be on exact and rigorous results, and the interrelationship between the various lattice models. In the many-body theory the off-diagonal matrix elements for inhomogeneous systems will be evaluated. The magnetic properties of a many-electron system will also be studied.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0015, POLARIZED NEUTRON SCATTERING BY SPIN WAVES IN FERROMAGNETIC MATERIALS

J.B. Sokoloff, Northeastern University, School of Liberal Arts, Dept. of Physics, *360 Huntington Ave., Boston, Massachusetts* 02115 (DMR79-06371)

A preliminary inelastic neutron scattering experiment on nickel with polarized neutrons indicated magnon scattering for neutrons polarized against the sample magnetization for temperatures above 0.9 Tc (curie temperature), in violation of the conventional Stoner theory of magnetism in metals based on the random phase approximation. These measurements on nickel will be extended to other neutron wavevectors and applied magnetic fields, in conjunction with complementary theoretical work, to study the microscopic structure of magnetization fluctuations or droplets. Such fluctuations are believed to be described by some form of soliton theory, and the results may provide a direct check on such theories. These studies will be extended to other metallic ferromagnets, as well as one and two dimensional ferromagnets, which are described by the localized spin model of magnetism.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0016, MILLIMETER MICROWAVE SPECTROSCOPY OF HIGH-PURITY METALS

G.L. Dunifer, Wayne State University, School of Liberal Arts, Dept. of Physics, *4841 Cass Ave., Detroit, Michigan* 48202 (DMR72-00181 A01)

Investigations of the microwave properties of metals begun under NSF Grant GH-39825 will be continued. The transmission of microwaves at 80GHz through thin plates of pure metal under conditions of varying magnetic field strength, orientation, and temperature will be measured. A careful study of spin wave excitations in the conduction electrons of aluminum will be carried out for samples of optimum thickness and orientation to obtain accurate measurements of the relevant Landau Fermi-Liquid Parameters. The Conduction Electron Spin Resonance (CESR) and possible spin wave excitations of copper and silver will be examined to obtain information at high microwave frequencies on g-anisotropy of the Fermi surface and exchange interactions among the conduction electrons. Finally, an extensive study of the alkali metals will be made, including a search for new physical effects which should occur only at millimeter microwave frequencies.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0017, INTERFACE AND DEPTH INHOMOGENEITY BY ELLIPSOMETRY

N.M. Bashara, University of Nebraska, Lincoln Campus, School of Engineering & Technology, Dept. of Electrical Engineering, *Lincoln, Nebraska* 68508 (DMR76-19048 A01)

Internal reflection ellipsometry (IRE), a relatively new technique, will be used to study the solid-solid interface and defect profiles in single crystal hemicylinders of silicon and gallium arsenide and an insulating overlay such as silicon dioxide. This technique has excellent potential in the semiconductor industry as a nondestructive means of assuring homogeneity of and measuring gradients in composition and defect content.

A second part of the program will be to further extend at-the-surface ellipsometry on epitaxial layers of phosphorus on silicon to correlate with assumed profile models. An ancillary portion of the project will be to use internal reflection ellipsometry at liquid-liquid interfaces in order to develop simplified IRE procedures. An extension of the theory of IRE will be made to anisotropic liquid-liquid interfaces with the intent of ultimately applying it to solids.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0018, THEORETICAL SOLID-STATE PHYSICS
E. Abrahams, Rutgers the State University of New Jersey, New Brunswick Campus, School of Arts & Sciences, Dept. of Physics, *Old Queens Bldg., New Brunswick, New Jersey* 08903 (DMR76-23330 A01)

Research in theoretical solid-state physics carried out under grant DMR72-03230 will be continued. In particular, the program will be directed toward three general problems: (1) Transport coefficients of the normal Fermi liquid will be calculated by extending Eliashberg's theory to include finite temperature corrections. (2) The coupling of electrons to sound waves in piezoelectric materials will be studied, including the effect of this coupling on transport properties. (3) Research on dynamical phenomena near the lambda transition in liquid helium will be continued.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0019, PURCHASE OF A HIGH POWER UV ARGON LASER FOR CW OPERATION
H.Z. Cummins, City University of New York, City College, School of Liberal Arts & Sciences, Dept. of Physics, *Convent Ave. & 138th St., New York, New York* 10031 (DMR79-05534)

Funds are granted for the acquisition of UV argon-pump laser capable of continuous-wave operation in the 4400-5000A wavelength range with a tunable dye laser. This apparatus will be used to study resonant Brillioiun scattering in cadmium sulfide and other semiconductors with particular emphasis on effects related to interacting exciton-polaritons at high pumping intensities.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0020, EXPERIMENTAL STUDIES AT LOW TEMPERATURE
D.H. Douglass, University of Rochester, School of Arts & Sciences, Dept. of Physics & Astronomy, *260 Crittenden Blvd., Rochester, New York* 14627 (DMR78-10260)

This is a continuation of work sponsored under DMR-7621622. An experimental study will be made of synthesis and properties of superconducting transition metal compounds. Studies will be made of sputtered transition metal carbides and of various chromium alloys. A new program will be initiated to study the properties of materials at low temperature. An experimental study of second sound in a single crystal of sapphire will be initiated. Measurement of internal friction in crystals of silicon and sapphire will be made. This work is important for understanding the process of synthesis of high-temperature superconducting materials.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0021, ATOMIC SCATTERING FROM SOLIDS II
E.D. Thompson, Case Western Reserve University, School of Engineering, Dept. of Electrical Engineering & Applied Physics, *University Cir., Cleveland, Ohio* 44106 (DMR79-01658)

Research previously supported by DMR7681184.

Molecular-solid surface scattering calculations, including both elastic and inelastic effects, will be performed, and, from the results and comparisons with experimental data, the dynamical interactions between the molecule and the solid surface will be ascertained. These dynamical interactions are fundamental to understanding such phenomena as physical adsorption, catalytic reactivity, surface viscous drag, and energy transfer. Surface structure analysis from atomic scattering will be carried out for silicon and other semiconductor materials as data become available.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0022, DIAMOND II A RESISTIVITY, DIELECTRIC CONSTANT, AND TANGENT DELTA FROM 10GHZ-100GHZ AS WELL THERMAL CONDUCTIVITY FROM 0 TO 500 DEGREES C
D. Hazony, Case Western Reserve University, School of Science, Dept. of Physics, *2165 Adelbert Rd., Cleveland, Ohio* 44106 (NAG 3-24)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

8.0023, FERROMAGNETIC RESONANCE IN COMPLEX MAGNETIC SYSTEMS
P.E. Wigen, Ohio State University, Columbus Campus, School of Mathematics & Physical Sciences, Dept. of Physics, *164 W. 17th Ave., Columbus, Ohio* 43210 (DMR78-10300)

The magnetic properties of materials at solid surfaces and of thin films are often quite different from the properties in bulk samples. This is an active area of solid physics which may lead to new phenomena or new electronic structures. Ferromagnetic spinwave resonance will be used to investigate a variety of magnetic interactions in thin films of Yttrium Iron Garnet (YIG). Magnetic interactions of the YIG surface with magnetic metals will be investigated. In particular, recent theories predict that vanadium metal will have an antiferromagnetic surface layer, two or three atomic layers thick. The YIG surface is very sensitive to the onset of such interactions and will be used to study this effect. The exchange coefficient in magnetically diluted sublattices will be studied and compared with recent theories.

This research was previously supported under DMR-7614450.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0024, RADIATION-INDUCED DEFECTS IN ALKALINE-EARTH OXIDES
L.E. Halliburton, Oklahoma State University, Agricultural Experiment Station, Dept. of Physics, *107 Whitehurst Hall, Stillwater, Oklahoma* 74075

The various trapping sites for radiation-induced oxygen interstitials are being investigated in single crystals of MgO. Following neutron irradiation, the samples are examined by electron spin resonance (ESR) and electron-nuclear double resonance (ENDOR). By eliminating the oxygen interstitial trapping sites, the build-up of radiation damage within oxide materials can be prevented. This will allow their electronic and structural integrity to be maintained in hostile environments.

SUPPORTED BY Oklahoma State Government

8.0025, FRACTIONAL CIRCULAR POLARIZATION FROM WHITE DWARFS AND PULSAR RADIATION
N.V. Swamy, Oklahoma State University, Agricultural Experiment Station, Dept. of Physics, *107 Whitehurst Hall, Stillwater, Oklahoma* 74075

The model of a charged non-relativistic oscillator does not explain the observed fractional circular polarization in the radiation from white dwarfs. The contribution from the intrinsic magnetic moment of the charged particle as well as from relativistic effects has been studied. Regarding pulsar radiation, modification of the arrival times of different frequency components in the radiation from pulsars due to the presence of magnetic charges has been studied using a plasma fluid approach.

SUPPORTED BY Oklahoma State Government

8.0026, COLLABORATIVE RESEARCH ON NUCLEAR PHYSICS AT INTERMEDIATE ENERGIES
L.W. Swenson, Oregon State Higher Education System, Oregon State University, School of Science, Dept. of Physics, *126 Agricultural Hall, Corvallis, Oregon* 97331 (PHY76-82333 A03)

Experiments will be conducted at the Los Alamos Meson Physics Facility (LAMPF) and at the TRIUMF cyclotron in Vancouver.

At LAMPF, the pion beam will be used to continue studies of particles emitted from the nucleus in coincidence with inelas-

tically scattered pions to try to understand what are the processes which initially occur when pions interact with nuclei. When the high-resolution EPICS spectrometer is completed, studies of elastic and inelastic scattering of positive and negative pions from nuclei will be conducted with special attention to studies of proton and neutron densities in the nuclear surface. Studies of X-rays emitted by muonic atoms will be conducted to obtain information on nuclear shapes in the mass-190 region. A study will be conducted to measure neutrons and protons emitted in muon capture on nuclei; the proton spectra are expected to give information on the importance of charge-exchange processes at medium energies.

At TRIUMF, a variety of experiments will utilize the special features of that accelerator-polarized protons, energy variability and high duty factor. These will include elastic and inelastic scattering of 200-550 MeV protons, proton-proton bremsstrahlung and coincidence studies of muonic atoms.

This work is a continuation of work supported by the Foundation under grant PHY76-82333.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0027, THEORETICAL RESEARCH IN SOLID-STATE PHYSICS

J.R. Schrieffer, University of Pennsylvania, School of Arts & Sciences, Dept. of Physics, *34th & Spruce Sts., Philadelphia, Pennsylvania* 19104 (DMR77-23420)

Theoretical research in condensed matter physics previously supported by NSF grant DMR-7681602 will be continued. The primary focus of this research will be in the area of surface physics. The emphasis, however, will be shifted from application of many-body theories to accurately handle exchange and correlation effects in the strongly inhomogenous electron systems encountered in surface physics problems. The one-electron methods will be improved, particularly in relation to interpreting experimental work with surface spectroscopics. Also, nonlinear excitations in lattices and coupled electron-lattice systems will be investigated.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0028, NUCLEAR STRUCTURE AND NUCLEAR REACTIONS

B.L. Cohen, University of Pittsburgh, School of Arts & Sciences, Dept. of Physics, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (PHY77-24134)

This proposed action will support the operation of the laboratory and the research program in nuclear structure and reaction studies. In addition, some work in nuclear applications and energy-related research will be supported. The nuclear physics program is a healthy mix consisting of some continuing productive programs and some work in new directions. Perhaps the most obvious example of a new area is the proposed research in weak interactions which will test the fundamental conserved vector current (CVC) theory of beta-decay. The studies of heavy-ion fusion and total reaction cross sections are also new areas which are of considerable interest in heavy-ion physics. Work will also continue in areas which have proved particularly fruitful in the past. For example, the pioneering work on quadrupole moment measurements of the first excited states of many nuclei will be extended to look at higher moments in samarium isotopes and to examine the quadrupole moments of excited bands. Studies of the nuclear continuum, a region which has generally received little attention until recently, will also be extended, possibly with the use of heavier ions.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0029, STUDIES OF THE PHYSICS AND CHEMISTRY OF THE TERRESTRIAL ATMOSPHERE

E.C. Zipf, University of Pittsburgh, School of Arts & Sciences, Dept. of Physics & Astronomy, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (NAG 6-2)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Wallops Flight Center

8.0030, THEORETICAL STUDY OF ELECTRON-ELECTRON INTERACTIONS AMONG THE CONDUCTION ELECTRONS IN SOLIDS

J.J. Quinn, Brown University, Graduate School, Dept. of Physics, *University Hall, Box 1843, Providence, Rhode Island* 02912 (DMR78-08556)

Research previously supported by DMR7401454.

Theoretical research in solid-state physics will be carried out. Topics which will be investigated will include: (1) The electrosic properties of semiconducting surface space charge layers. These systems exhibit intrinsically interesting phenomena and are of technological interest for the development of MOSFET devices. (2) The normal modes of a semi-infinite solid, such as surface phonons and plasmons. These have an effect on such experimental surface probes as Raman scattering and attenuated total reflection. (3) Electron-hole scattering in semimetals and semiconductors, which is an important mechanism for understanding the conductivity in these materials.

This is the first year of a 3-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0031, CODEPOSITION FACILITY FOR AMORPHOUS TRANSITION METAL ALLOYS

D.G. Naugle, Texas A & M University, College Station Campus, School of Science, Dept. of Physics, *College Station, Texas* 77843 (DMR78-10900)

A facility for making multicomponent amorphous superconducting alloys and for making in-situ measurements will be developed. This facility consists of a high vacuum chamber, a liquid helium cryostat, a superconducting magnet, electron beam deposition-equipment and the equipment necessary to monitor the vacuum and composition of the atmosphere. Thin films of amorphous metals will be made so that a wide range of experiments can be done to explore their unusual properties. The effect of the method of preparation on the physical properties will be examined.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0032, ADMINISTRATIVE SUPPORT FOR THE SOLAR POWER SATELLITE CONCEPT EVALUATION RESOURCE ANALYSIS WORKSHOP

R.E. Thomas, Texas A & M University, College Station Campus, School of Science, Dept. of Physics, *College Station, Texas* 77843 (NAS 9-16059)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

8.0033, DYNAMIC AND COLLECTIVE EFFECTS IN PARAELECTRIC AND PARAELASTIC SYSTEMS

B.G. Dick, Utah Higher Education System, University of Utah, School of Science, Dept. of Physics, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (DMR77-25773)

Several theoretical problems connected with orientable ions in ionic crystals will be studied: (1) Development of strong coupling polaron theory of phonon assisted tunneling of paraelectric-paraelastic defects. (2) Study of the various processes which produce Arrhenius-like transition rates for systems. (3) Interference effects in transitions between tunneling as opposed to directed states. (4) Cooperative phenomena in mixed alkali halide-cyanide crystals. (5) Phonon scattering from tunneling defect systems with more than two sites, with strong defect-lattice interaction, and the relaxation of the Condon approximation. (6)

A simple tunneling-optical dichroism based theory for Raman scattering of tunneling defects.
Research previously supported by DMR73-02516.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0034, THE NUCLEATION, GROWTH, AND IN-SITU OXIDATION OF MICROSCOPIC CRYSTALLITES OF TRANSITION METALS ON REFRACTORY OXIDE SUBSTRATES
J.T. Dickinson, Washington State University, School of Arts & Sciences, Dept. of Physics, *Administration Bldg., Room 101, Pullman, Washington* 99163 (NCC 2-69)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

SOCIAL SCIENCES

Includes Social Sciences (general); Administration and Management; Documentation and Information Science; Economics and Cost Analysis; Law and Political Science; and Urban Technology and Transportation.

9.0001, SOIL INTERPRETATIONS AND SOCIOECONOMIC CRITERIA FOR LAND USE PLANNING
G.A. Nielsen, Montana State University, Agricultural Experiment Station, Dept. of Plant & Soil Science, *Bozeman, Montana* 59715 (0074442; MONB00377)

OBJECTIVE: Determine biophysical and socioeconomic factors that influence non-urban land use. Organize and deliver existing biophysical and socioeconomic land related data needed for land-use policy making and planning. Identify and develop critically needed data and interpretations for land-use policy making and planning; develop and evaluate alternatives to overcome soil limitations affecting land-use and environmental degradation.

APPROACH: Prepare a county resource inventory handbook to optimize the use of land resource data. Compile State General Soil Maps and develop a computer-graphic system that identifies land-use potentials. Focus effort on the effects of soil temperature and moisture regimes on soil use and test models for predicting these regimes.

PROGRESS: The Montana Land Resources Demonstration Project is investigating the use of remote sensing imagery to determine land use and cover information. This project, a cooperative effort of Montana's Department of Natural Resources, Department of Revenue, Montana State University, and NASA uses LANDSAT multispectral scanner digital imagery. The output will identify the following land uses: irrigated and dryland agriculture, range, saline seep, water, and wetlands. Statistical analyses relating land use to location variables will be feasible. A Montana Land Use Map (1:1,000,000 scale) is being prepared from color composite photos utilizing LANDSAT multispectral bands 4, 5, and 7 (green, red, infrared). Digitally enhanced LANDSAT imagery is being analyzed by ground truth in Southwestern Montana to determine its usefulness for planning. A computer graphic system containing 18 soil, climatic, geologic, and vegetative parameters is being used to help guide research programs. It was used to help select the location for a new research center and to locate agricultural areas similar to Montana's six existing research centers. A 1:1,000,000 scale map of Montana showing 'Areas Where Summer Fallow May Not Be Recommended' was compiled based on soil water holding capacity and early spring soil moisture. It was printed in newspapers throughout Montana to reach appropriate crop producers. The Blue Ribbons 208 Areawise Planning Organization in Southwestern Montana is charged with enhancing water quality.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, Montana

9.0002, SOIL INTERPRETATIONS AND SOCIOECONOMIC CRITERIA FOR LAND USE PLANNING
W.R. Butcher, Washington State University, College of Agriculture, Dept. of Agricultural Economics, *Pullman, Washington* 99163 (0072194; WNP00366)

OBJECTIVE: Determine biophysical and socioeconomic factors in influencing non-urban land use. Organize and deliver existing bio-physical and socioeconomic land related data needed for land use policy making and planning. Develop critically needed data and interpretations for land use, policy making and planning; develop and evaluate alternatives to overcome soil limitations and environmental degradation.

APPROACH: Available studies will be utilized to assess the likelihood of shortages in the national and international markets the Washington agricultural lands might serve and then applied to the concept of social opportunity costs to assess possible gains and losses not reflected in market prices. An analysis will be made of aerial photos taken at time intervals to identify and tabulate land conversions and relate these to levels of population and economic activity in order to establish and estimate functional relationships linking the demand for land to independent variables and prepare estimates of future levels of demand for agricultural land. Users and developers of converted lands within a specific area will be interviewed to devise developer and land user criteria models and both the economic and social costs and benefits will be estimated. A set of policy alternatives will be developed from secondary sources, and the results of the study and probable response to these policies will be estimated.

PROGRESS: Analysis of costs for 20 housing developments in Clark County, Washington showed costs to be lowest and profits highest for small (4 lots or less) developments within urban areas. Lowest profits were for small rural developments because of large land requirements per lot and the high costs of providing water, sewerage, access and other services to a small number of dispersed residences. Among more conventional subdivisions, costs per lot tended to be lower for large lot developments and for larger subdivisions, up to 60 lots. Neither cost nor selling prices were related to distance from the central business district. Total costs of development and urban services would be much less if developments were closely grouped on small lots. A survey of land buyers, sellers and owners will be conducted in January and February and an analysis made of effects on the land market.

SUPPORTED BY Washington State Government

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, THE X-RAY PROPERTIES OF WELL-STUDIED INTERMEDIATE AND LARGE RED SHIFT QUASI-STELLAR OBJECTS - A PILOT STUDY
P.A. Strittmatter, University of Arizona, Steward Observatory, *Tucson, Arizona* 85721 (NAG 8-321)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0002, X-RAY OBSERVATIONS OF T TAURI STARS
W.D. Decampli, California Inst. of Technology, Graduate School, Dept. of Physics Mathematics & Astronomy, *1201 E. California Blvd., Pasadena, California* 91109 (NAG 8-322)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0003, LOCATION OF HIGH ENERGY ASTRONOMICAL OBSERVATORY-A2 SOFT X-RAY SOURCES, MAP DIFFUSE FEATURES NEAR GALACTIC CENTERS (ABBREV)
G.P. Garmire, California Inst. of Technology, Graduate School, Dept. of Physics Mathematics & Astronomy, *1201 E. California Blvd., Pasadena, California* 91109 (NAG 8-324)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0004, INVESTIGATION OF STELLAR CHROMOSPHERIC AND CORONAL ACTIVITY
H. Zirin, California Inst. of Technology, Graduate School, Dept. of Physics Mathematics & Astronomy, *1201 E. California Blvd., Pasadena, California* 91109 (NAG 8-313)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0005, A STUDY OF THE SIZE AND COMPOSITION OF INTERSTELLAR GRAINS
A.B. Walker, Stanford University, School of Humanities & Sciences, Dept. of Applied Physics, *Stanford, California* 94305 (NAG 8-325)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0006, OBSERVATION OF RICH GALAXY CLUSTER ON HIGH ENERGY ASTRONOMICAL OBSERVATORY-B GUEST INVESTIGATOR PROGRAM
J.I. Silk, University of California, Berkeley Campus, School of Letters & Science, Dept. of Astronomy, *Berkeley, California* 94720 (NAG 8-311)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0007, EXTENDED GASEOUS HALOS OF GALAXIES AND GASEOUS HALOS OF EXTENDED RADIO GALAXIES
J.I. Silk, University of California, Berkeley Campus, School of Letters & Science, Dept. of Astronomy, *Berkeley, California* 94720 (NAG 8-320)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0008, HIGH RESOLUTION X-RAY, OPTICAL AND RADIO IMAGERY OF PARKS 0837-12
H. Spinrad, University of California, Berkeley Campus, School of Letters & Science, Dept. of Astronomy, *Berkeley, California* 94720 (NAG 8-333)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0009, EVOLUTION OF FE ABUNDANCE IN CLUSTERS OF GALAXIES
W.J. Welsh, University of California, Berkeley Campus, School of Letters & Science, Dept. of Astronomy, *Berkeley, California* 94720 (NAG 8-312)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0010, X-RAY OBSERVATIONS OF RADIO BURSTING QUASARS NRAL0140 AND NRA0530 ON THE HIGH ENERGY ASTRONOMICAL OBSERVATORY-B GUEST INVESTIGATOR PROGRAM
A.P. Marscher, University of California, San Diego Campus, Graduate School, Dept. of Physics, *P.O. Box 109, La Jolla, California* 92037 (NAG 8-315)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0011, X-RAY EMISSION FROM STARS & PRESENCE OF A STELLAR WIND & STELLAR ROTATION RATE & CORONAE IN 3 PECULIAR LATE-TYPE STARS (ABBREV)
J.L. Linsky, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Astro Geophysics, *1200 University Ave., Boulder, Colorado* 80302 (NAG 8-334)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0012, X-RAY EMISSION FROM NORMAL AND PECULIAR A STARS WITH THE EINSTEIN OBSERVATORY AND SEARCH FOR SOFT X-RAY VARIABILITY IN OB STARS
T.P. Snow, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Physics & Astrophysics, *1200 University Ave., Boulder, Colorado* 80302 (NAG 8-327)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0013, SUPPORT OF THE GEOPHYSICS RESEARCH BOARD (GRB), AND THE COMMITTEE ON SOLAR-TERRESTRIAL RESEARCH (CSTR) (ABBREV)
P.J. Hart, National Academy of Sciences, National Research Council, *2101 Constitution Ave. N.W., Washington, District of Columbia* 20418 (EAR79-01089)

This award will continue the operations of the Geophysics Research Board and one of its committees, the Commmittee on Solar-Terrestrial Research (CSTR) of the National Academy of Sciences for one period commmencing January 1, 1979. The board, operating primarily through its committees, develops and coordinates U.S. contributions to international geophysical programs such as the programs of the Special Committee of Solar-Terrestrial Physics (SCOSTEP) and the Inter-Union Commission of Geodynamics. It conducts studies in major areas of the geophysical sciences and couperates with the various committees and unions of the International Council of Scientific Unions. Close liaison is maintained with government agencies actively participating in the execution of the domestic programs. The CSTR includes the committee itself, the Panel on the International Magnetospheric Study (IMS), and a working group on the Middle Atmosphere Program (MAP). The CSTR was established to plan and coordinate programs in solar-terrestrial relationships, to keep under review the status of U.S. research in this field, and to develop recommendations on the national solar-terrestrial research programs and the international coordination of such programs. It conducts studies broadly dealing with solar-terrestrial physics. Through the CSTR IMS panel and MAP working group, it provids advice, planning, and recommendations regarding U.S. participation in the IMS and MAP. Provision is made in this award for one meeting each of the CSTR, the IMS panel, and the MAP working group, and one additional meeting of a subgroup of the CSTR, IMS panel and AMP working group.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Earth Sciences

10.0014, DISTANT ABELL CLUSTERS DISCOVERED AS X-RAY SOURCES BY HIGH ENERGY ASTRONOMICAL OBSERVATORY-A-1 & OBSERVATIONS OF IC 3576 & NGC 4410 A/B
M.P. Ulmer, Northwestern University, Evanston Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *633 Clark St., Evanston, Illinois* 60201 (NAG 8-326)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0015, INVESTIGATION OF X-RAY SPECTRA OF ACCRETING NON-MAGNETIC DEGENERATE DWARFS
D.Q. Lamb, University of Illinois, Urbana Champaign Campus, School of Arts & Sciences, Dept. of Astronomy, *Urbana, Illinois* 61801 (NAG 8-310)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0016, OLD SUPERNOVA REMNANTS & STUDY OF YOUNG SUPERNOVA REMNANTS CASSIOPEIA A & TYCHO OF HIGH ENERGY ASTRONOMICAL OBSERVATORY (ABBREV)
J.R. Dickel, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Astronomy, *Urbana, Illinois* 61801 (NAG 8-317)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0017, X-RAY & OPTICAL PROPERTIES OF S-TYPE MARKARIAN GALAXIES - SIMULTANEOUS PHOTOMETRIC & SPECTROSCOPIC OBSERVATIONS OF X PERSEI
S.L. Mufson, Indiana University, Bloomington Campus, School of Arts & Sciences, Dept. of Astronomy, *Memorial Hall, Bloomington, Indiana* 47401 (NAG 8-331)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0018, X-RAY STUDY OF ELLIPTICAL AND SO GALAXIES WITH COMPACT NUCLEAR RADIO
A.S. Wilson, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Astronomy, *College Park, Maryland* 20742 (NAG 8-329)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0019, SECULAR VARIATIONS IN PULSAR TEMPERATURES
G. Greenstein, Amherst College, School of Liberal Arts, Dept. of Astronomy, *Box 65, Amherst, Massachusetts* 01002 (NAG 8-330)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0020, AN X-RAY STUDY OF AM CANUM VENATICORUM (A STAR)
J. Patterson, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Astronomy, *Ann Arbor, Michigan* 48104 (NAG 8-318)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0021, SEARCH FOR DECREASE IN RADIO PULSAR X-RAY LUMINOSITY DURING RADIO NULLS
A.F. Cheng, Rutgers the State University of New Jersey, New Brunswick Campus, School of Arts & Sciences, Dept. of Astronomy, *Old Queens Bldg., New Brunswick, New Jersey* 08903 (NAG 8-328)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0022, X-RAY IMAGING OBSERVATIONS OF H II REGION MOLECULAR CLOUD COMPLEXES USING HIGH ENERGY ASTRONOMICAL OBSERVATORY-B
M. Simon, State University of New York, Stony Brook Campus, School of Arts & Sciences, Dept. of Earth & Space Sciences, *Stony Brook, New York* 11790 (NAG 8-332)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0023, EXPERIMENTAL STUDIES OF GRAVITATION
D.H. Douglass, University of Rochester, School of Arts & Sciences, Dept. of Physics & Astronomy, *260 Crittenden Blvd., Rochester, New York* 14627 (PHY77-07315 A02)

Research will continue on the design and operation of gravitational wave detectors of greatly increased sensitivity. A conventional room-temperature detector has been improved, and will continue in operation to search for signals at a level of 1 GPU. The feasibility study on dielectric detectors will be completed, and a small silicon crystal will be used as an antenna. Future work will include construction and use of a large (100 kg) crystal cryogenic detector which is expected to have a sensitivity in the range of 10 to the minus 3rd power to 10 to the minus 7th power GPU.

This work is a continuation of that currently supported under NSF grant number PHY72-04755 A05.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

10.0024, PHOTOMETRY, SPECTROSCOPY AND INTERFEROMETRY OF IRREGULAR GALAXIES
G.H. de Vaucouleurs, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Astronomy, *200 W. 21st St., Austin, Texas* 78712 (AST7808744)

A comprehensive photometric spectroscopic and interferometric study of late-type spirals and irregular galaxies, particularly of the magellanic type will be carried out. This is a relatively neglected field of optical extragalactic astronomy (excepting the Magellanic Clouds themselves), but one which is of special interest to radio astronomers because of the high hydrogen content of this class of galaxies, leading to a high rate of star formation, an abundance of supergiant stars and, in some sense, a rapid rate of evolution. The complex structure and internal motions of these irregular, often asymmetric systems is also a challenge to theories of galaxy formation and dynamics.

The expected results of this project would provide observations for most of the nearest and/or largest Magellanic irregulars and related late-type systems listed in the article by de Vaucouleurs and Freeman in Vistas in Astronomy, Volume 14 (1922). The DDO dwarfs detected at 21 cm. need to be observed. Information on the structure and morphology, luminosity and stellar density distributions, total magnitudes and effective diameters, colors, stellar and galaxian luminosity functions, distances and space density, H II regions and H emission, rotation, velocity dispersion and other motions, total masses and comparisons with H I data will be provided.

The tools and techniques for such a comprehensive study have been developed and are available to us at McDonald Observatory or through our associates. This is a continuation of research done under grant AST 75-22900 A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0025, ASTROMETRIC STUDIES OF NEARBY STARS FROM THE SOUTHERN HEMISPHERE
P.A. Ianna, University of Virginia, Leander McCormick Observatory, *Garrett Hall, Charlottesville, Virginia* 22903 (INT77-21525)

Under this new award, work will continue for two years on a cooperative program begun in January, 1976, with the Australian National University's Mount Stromlo and Siding Spring Observatory for the determination of the trigonometric parallaxes and proper motions of nearby, astrophysically important stars in the Southern Hemisphere. Since the inception of the program, a total of 984 photographic plates of 71 star fields have been obtained. In the coming year, approximately 100 stars will be added to the program, including 15 bright, late-type giants to aid in luminosity calibration problems. The work to date has taken place under grant OIP 75-22605 in the first year and renewal INT 75-22605 A01 in the second.

Parallax and proper motions of nearby stars are important in determining distances and motions that permit astronomers to derive true luminosity and, with other data, the masses of stars in double star systems. Motions furnish data for understanding the structure of the Milky Way and astrometric measures also supply the yardstick for calibration of the cosmic distance scale.

The photographic observations, which focus on white dwarfs and other stars of low luminosity, are obtained with the Mt. Stromlo 66-cm refractor and subsequently measured and reduced at the University of Virginia's observatory. A special effort is being made to coordinate the photographic observa-

tions of a small sample of stars accessible to both McCormick and Mt. Stromlo. The program affords a unique opportunity for detailed data comparison between a Northern and a Southern Hemisphere refractor and an astrometric reflector to investigate sources of accidental and systematic errors in stellar parallaxes. D.S. Mathewson has replaced O.J. Eggen as the Australian principal investigator.

SUPPORTED BY U.S. National Science Foundation, Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

10.0026, X-RAY EMISSION FROM OPTICALLY QUIET RADIO SOURCES, LACERTAE OBJECTS & BRIGHT OPTICALLY SELECTED QUASARS (ABBREV)
S.L. Odell, Virginia Polytechnic Inst. & State University, School of Arts & Sciences, Dept. of Physics, *Blacksburg, Virginia* 24061 (NAG 8-314)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0027, A STUDY OF SOFT X-RAY ABSORPTION BY DENSE INTERSTELLAR CLOUDS UNDER THE HIGH ENERGY ASTRONOMICAL OBSERVATORY-B GUEST INVESTIGATOR PROGRAM
W.L. Kraushaar, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Physics, *500 Lincoln Dr., Madison, Wisconsin* 53706 (NAG 8-319)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

GENERAL

11.0001, OPERATION OF THE LEWIS RESEARCH CENTER VISITOR INFORMATION CENTER
M.R. Lewis, California State University & Colleges, California State University, Chico Campus, Graduate School, *Chico, California* 95929 (NAS 3-22172)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

11.0002, COMPARATIVE EVALUATION OF WORKLOAD ESTIMATION TECHNIQUES IN PILOTING TASKS
W.W. Wierwille, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Industrial Engineering & Operations Research, *Blacksburg, Virginia* 24061 (NAG 2-17)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

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Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N80-30272 Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).

MULTILINGUAL AERONAUTICAL DICTIONARY

1980 896 p In ENGLISH, FRENCH, DUTCH, GERMAN, GREEK, ITALIAN, PORTUGUESE, TURKISH, SPANISH, and RUSSIAN (LC-77-93566; ISBN-92-835-01666-7) Avail: NTIS HC $123.50; Distributed In North America by NTIS, 5285 Port Royal Road, Springfield, Va., USA and Distributed Outside North America by AGARD, 7 rue Ancelle, 92200 Neuilly sur Seine, France

A multilingual dictionary to aid scientists, engineers, and translators in the field of aeronautics was developed. The dictionary contains an alphabetical list of English terms, accompanied by English language definitions and translations of each term into the nine other languages. Nine alphabetical lists of terms in the languages other than English are included, each term accompanied by a reference number, keyed to its English language equivalent. A list of English acronyms, abbreviations, and symbols is also included, each accompanied by its expansion in English. J.M.S.

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

N80-30273*# McDonnell-Douglas Research Labs., St. Louis, Mo.

COMBINED LINEAR THEORY/IMPACT THEORY METHOD FOR ANALYSIS AND DESIGN OF HIGH SPEED CONFIGURATIONS Final Report

D. Brooke and D. V. Vondrasek Washington NASA Sep. 1980 34 p refs

(Contract NAS1-15535)

(NASA-CR-3314) Avail: NTIS HC A03/MF A01 CSCL 01A

Pressure distributions on a wing body at Mach 4.63 are calculated. The combined theory is shown to give improved predictions over either linear theory or impact theory alone. The combined theory is also applied in the inverse design mode to calculate optimum camber slopes at Mach 4.63. Comparisons with optimum camber slopes obtained from unmodified linear theory show large differences. Analysis of the results indicate that the combined theory correctly predicts the effect of thickness on the loading distributions at high Mach numbers, and that finite thickness wings optimized at high Mach numbers using unmodified linear theory will not achieve the minimum drag characteristics for which they are designed. R.K.G.

N80-30274*# Johns Hopkins Univ., Laurel, Md.

BANK-TO-TURN CONTROL TECHNOLOGY SURVEY FOR HOMING MISSILES

Frederick W. Riedel Sep. 1980 42 p refs

(NASA Order L-75242)

(NASA-CR-3325) Avail: NTIS HC A03/MF A01 CSCL 01A

The potential advantages of bank-to-turn control are summarized. Recent and current programs actively investigating bank-to-turn steering are reviewed and critical technology areas concerned with bank-to-turn control are assessed. Author

N80-30275# Tufts Univ., Medford, Mass. Dept. of Electrical Engineering.

PAYLOADS USED IN FIRST THREE DATA-GATHERING BAMM FLIGHTS

Alvin H. Howell Jan. 1980 30 p

(Contract F19628-77-C-0047; AF Proj. 6665)

(AD-A086839; AFGL-TR-80-0109; SR-3) Avail: NTIS HC A03/MF A01 CSCL 04/1

Payloads were configured for, and used in, three successful data-gathering balloon flights for the Balloon Altitude Mosaic Measurements (BAMM) program. All were significantly different, and each worked as planned. A radiometer and a TV camera were carried on Flight 1, and an interferometer was added for Flights 2 and 3. Recovery was by ground impact for the first two flights, but the third was snatched from the air by helicopter. GRA

N80-30276# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directories.

AN ANALYTICAL SOLUTION OF LIFT LOSS FOR A ROUND PLANFORM WITH A CENTRAL LIFTING JET

K. T. Yen 10 Mar. 1980 38 p refs

(WR02302000)

(AD-A086669; NADC-80057-60) Avail: NTIS HC A03/MF A01 CSCL 20/4

An analysis of the lift for a round planform fitted with a centrally-located round jet is presented. The pressure distribution over the lower surface of the planform is solved analytically by matching an inner viscous solution with an outer potential solution. By comparing the calculated pressure distributions with NACA experimental data, satisfactory agreement has been obtained, although the planforms are not exactly the same. In addition, Wyatt's formula for the lift loss is found to be essentially valid, but only under limited conditions, and an improved formula is suggested. Additional works, both experimental and theoretical, needed to solve the lift loss problem are discussed with recommendations. GRA

N80-30277# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.

EXPERIMENTAL STUDY OF THREE-DIMENSIONAL SHOCK WAVE TURBULENT BOUNDARY LAYER INTERACTION: SCALING OF SHARP AND BLUNT FIN-INDUCED FLOWFIELDS Final Report, 4 May 1978 - 3 May 1980

David S. Dolling and Seymour M. Bogdonoff Jul. 1980 61 p refs

(Contract N60921-78-C-0068; WR02302003)

(AD-A086875; MAE-1483) Avail: NTIS HC A04/MF A01 CSCL 20/4

An experimental study of three dimensional (3-D) shock wave turbulent boundary layer interaction has been carried out. Interactions generated by fin models having sharp and hemi-cylindrically blunted leading edges have been studied. Tests have been made using incoming turbulent boundary layer varying in thickness in the ratio of about 4:1. Extensive surface property measurements have been made on the test surface on which the incoming boundary layer developed and on the fin itself. All of these tests were carried out at a nominal freestream Mach number of 3, a freestream unit Reynolds number of about 63 million per meter, and under approximately adiabatic wall conditions. The emphasis in the study reported on in this paper was on two main areas. First, to determine the key geometric and/or flow parameters controlling the overall scaling and characteristics of both blunt and sharp fin-induced interactions. Second, to identify the conditions under which both blunt and sharp fins induced interactions have the same local scale and characteristics. GRA

N80-30278# Ballistic Research Labs., Aberdeen Proving Ground, Md.

EFFECT OF NEAR-ZERO SPIN ON INSTABILITY OF CONTROLLED PROJECTILES IN ASCENDING OR DESCENDING FLIGHT Final Report

Charles H. Murphy May 1980 21 p refs

(DA Proj. 1L1-61102-AH-43)

(AD-A086775; AD-E430473; ARBRL-MR-03023) Avail: NTIS HC A02/MF A01 CSCL 19/4

Lloyd and Brown have shown that constant-amplitude horizontal and vertical side forces applied to a spinning projectile can cause dynamic instability. A subsequent ARRADCOM report (AD-A072808) removed some of the limitations of the Lloyd-Brown work and gave somewhat more general results. Unfortunately, these results were applied in the report to a case for which they were unsuitable; a nonspinning statically stable missile. The present report derives correct results for the zero-spin case and shows that the results of the earlier report are valid for spin rates greater than about five times the resonant spin value. GRA

N80-30279# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.

QUANTITATIVE MEASUREMENTS OF THE EFFECTS OF VARIATIONS IN PANEL METHOD COMPUTER PROGRAMS Final Report

Wilson C. Obi Jan. 1980 155 p refs

(WF41400000)

(AD-A086358; NADC-80029-60) Avail: NTIS HC A08/MF A01 CSCL 20/4

Panel distributions have been characterized independently in terms of computable and controllable parameters. Thus, a methodology has been developed which will permit a conclusive establishment of the sensitivities of paneling parameters to aerodynamic estimation quality for a wide variety of paneling codes. It has been demonstrated that the global performance (input-output relationships, precision, and accuracy) of a panel method computer program can be established through calibration. Application of the sensitivity analysis developed herein to SURAIR (a Woodward constant pressure panel method derivative) has shown that it is possible to increase estimation accuracy without the commonly expected increase in computation cost. GRA

N80-30280# Tufts Univ., Medford, Mass. Dept. of Electrical Engineering.

NEW HARDWARE FOR TETHERED BALLOONS

Alvin H. Howell Jan. 1980 17 p

(Contract F19628-77-C-0047; AF Proj. 6665)

(AD-A086836; AFGL-TR-80-0108; SR-2) Avail: NTIS HC A02/MF A01 CSCL 01/3

Three hardware items have been produced which should be useful in tethered balloon operations. They are: a self contained balloon valve, called a smart valve, which can be used in a hostile environment; a general purpose tetrahedron, which simplifies balloon let-up when multiple tethers are employed; and quick acting coupling; which speed up the launch procedure. GRA

N80-30281# Arnold Engineering Development Center, Arnold Air Force Station, Tenn.

COMPARISON OF WIND TUNNEL AND FLIGHT TEST MEASUREMENTS OF STATIC AERODYNAMIC LOADING OF A CAPTIVE STORE Final Report, 18 Jun. 1976 - 31 Aug. 1978

R. E. Dix and G. R. Mattasits AEDC Jul. 1980 117 p Sponsored by Air Force

(AD-A087237; AEDC-TR-79-9) Avail: NTIS HC A06/MF A01 CSCL 01/1

A coordinated series of experiments was conducted in three wind tunnels and in flight to measure the static aerodynamic loading of a MK 83 store attached to the bottom center station of a triple ejector rack mounted on the left inboard pylon of an F-4 aircraft. Fundamental agreement between wind tunnel and inflight loads data was demonstrated over a range of angle of attack from -2 to 6 deg and a Mach number range from 0.6 to 0.9. Differences that were noted were thought to be attributable either to improper store-to-aircraft alignment or to poor definition of inertial loads during maneuvering flight. GRA

N80-30282# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).

STUDY OF AN EDGE VORTEX BY MEANS OF ULTRASOUND IN A CLOSE FIELD BEHIND A RECTANGULAR WING IN A WIND TUNNEL Thesis [UNTERSUCHUNGEN VON RANDWIRBELN MITTELS ULTRASCHALL IM NAHBEREICH HINTER EINEN RECHTECKFLUEGEL IM WINDKANAL]

Rolf H. Engler Aug. 1979 120 p refs In GERMAN

(MPIS-11/1979; ISSN-0436-1199) Avail: NTIS HC A02/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 21.45

The development of an edge vortex in a close field behind a rectangular wing was studied by means of alterations of short ultrasonic impulses. A spoiler was then fixed on the pressure side of the experimental wing. The influence of the small spoiler and of the fixation angle was examined. Author (ESA)

N80-30283# Messerschmidt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Flugzeuge.

A THEORETICAL INVESTIGATION OF THE SHOCK LOCATION ON AN AXISYMMETRIC BODY AND ON A TWO DIMENSIONAL AIRFOIL IN TRANSONIC FLOWS AFFECTED BY AXIAL PRESSURE GRADIENTS AND SHIFTS IN PRESSURE LEVEL

Richard Kleebaur 22 Jun. 1979 70 p refs In GERMAN; ENGLISH summary

(MBB-FE-124/S/PUB/9) Avail: NTIS HC A04/MF A01

The influence of pressure deviation on shock locations due to interference free, transonic wind tunnel flows was investigated. A finite element computer program was used to determine the shift in shock location on an axisymmetric body and on a two dimensional airfoil due to deviations in the static pressure level and due to axial pressure gradients in the theoretical model of a wind tunnel flow. Wall pressure measurements in a transonic wind tunnel enabled a comparison to be made between an experimentally determined shift and a calculated shift in shock location as affected by wall interference and with increasing Reynolds number. The result for the axisymmetry body shows that about half of the rearward shift of the shock, with increasing Reynolds number, can be attributed to interference measured on the wall of the wind tunnel. The calculations for the two dimensional case showed the high sensitivity of the shock location with deviations caused by interference free wind tunnel flow. Lack of wall pressure measurements prevented a quantitative correlation with Reynolds numbers for this case. Author (ESA)

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N80-30284# Naval Weapons Center, China Lake, Calif. Ordnance Systems Dept.

STORE SEPARATION TRAJECTORY ANALYSIS Progress Report, 1972 - 1978
Arthur R. Maddox Jan. 1980 25 p refs
(ZF32300000)
(AD-A086704; NWC-TP-6067) Avail: NTIS HC A02/MF A01 CSCL 19/4

A series of store drops was made at moderate to high subsonic speeds with the same configuration on the center position of a triple ejector rack on an F-4 inboard pylon. The data were compared with wind tunnel and mathematical simulations. Both estimation techniques predicted the general nature of the motion, especially at low speeds, but failed to predict a minor collision observed at high speed. GRA

N80-30285# Army Aviation Research and Development Command, St. Louis, Mo. Applied Technology Lab.
INVESTIGATION OF HELICOPTER WIRE STRIKE PROTECTION CONCEPTS Technical Memorandum, Aug. - Nov. 1979
LeRoy T. Burrows Jun. 1980 51 p
(DA Proj. 1L1-62209-AH-76)
(AD-A086857; USAAVRADCOM-TM-80-D-7) Avail: NTIS HC A04/MF A01 CSCL 01/2

In-flight wire strikes pose a serious threat to low-level helicopter operations. Tests were conducted to determine the suitability for U.S. Army helicopter applications of the Canadian Wire Strike Protection System (WSPS), developed by Bristol Aerospace Limited. The WSPS consists of fuselage-mounted upper and lower cutters and a windshield centerpost deflector with a sawtooth cutter. Using the NASA/Langley Research Center Crash Impact Dynamics Facility, an OH-58A fitted with the WSPS was subjected to pendulum swing tests in which the helicopter struck fixed cables at approximately 40 knots airspeed. The system demonstrated the capability to easily sever 10,000 pound strength 3/8 inch steel messenger cable, 50-pair copper communications cable, and 0.419 inch high power transmission lines, including multiple arrays of those cables. Data acquired indicated that the wire impact/deflection/cutting sequence would not have a significant effect on helicopter performance, control crew functioning, or blade flapping. Installation of the WSPS on the entire Army tactical helicopter fleet is recommended. An additional test of a device to deflect wires past the helicopter skid gear, vertical stabilizer, and tail rotor was conducted. A 7/8 inch tubular steel deflector was designed and fabricated. The device proved to be inadequate. It was concluded that a skid gear deflector is not a practical OH-58A retrofit from a cost and weight standpoint. GRA

N80-30286# Transportation Systems Center, Cambridge, Mass.
VORTEX ADVISORY SYSTEM. VOLUME 1: EFFECTIVENESS FOR SELECTED AIRPORTS Final Report, Sept. - Dec. 1977
J. N. Hallock May 1980 122 p refs
(AD-A086982; TSC-FAA-80-11-1-Vol-1; FAA-RD-80-62-1-Vol-1) Avail: NTIS HC A06/MF A01 CSCL 17/7

The Vortex Advisory System (VAS) is based on wind criterion--when the wind near the runway end is outside of the criterion, all interarrival Instrument Flight Rules (IFR) aircraft separations can be set at 3 nautical miles. Five years of wind data have been obtained for 20 airports. By comparing the VAS wind criterion to the 5 years of wind data, the percentages of time that interarrival separations can be reduced at the 20 airports have been found. The percentages are given on an hourly and a monthly basis. Volume 2 (to be published at a later date) will examine the VAS effectiveness at Chicago O'Hare (ORD) with respect to the length of the intervals during which reduced separations might have been used. GRA

N80-30287# National Transportation Safety Board, Washington, D. C. Bureau of Technology.
LIGHT TWIN-ENGINE AIRCRAFT ACCIDENTS FOLLOWING ENGINE FAILURES Special Study, 1972 - 1978
13 Dec. 1979 89 p refs
(PB80-177306; NTSB-AAS-79-2) Avail: NTIS HC A05/MF A01 CSCL 01B

Data collected during the investigation of 477 light-twin aircraft accidents from 1972 through 1976 which involved engine failure or malfunction were studied. Pilot handbooks and other sources which provide information on engine-out performance and emergency procedures in light-twins were reviewed. A limited number of interviews with pilots and instructors were conducted. FAA training regulations were also studied. A major conclusion reached is that many of these accidents involved a lack of pilot proficiency in managing a light-twin after loss of power on one engine. Four recommendations are made to the FAA for corrective action and one previously made recommendation is reiterated. GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N80-30288# Army Research Inst. for the Behavioral and Social Sciences, Alexandria, Va. Flight Training and Aviator Selection.
TACTICAL NIGHT TERRAIN FLIGHT NAVIGATION Final Report
James A. Bynum and Garvin L. Holman Sep. 1979 49 p refs
(DA Proj. 2Q2-63743-A-772)
(AD-A086458; ARI-RR-1226) Avail: NTIS HC A03/MF A01 CSCL 01/2

This report documents two experiments which were conducted to determine the training required to improve tactical night terrain flight aircrew performance. These experiments sought, specifically, to identify critical factors which should be included in a program of instruction for tactical night terrain flight navigation training with unaided vision. In the first experiment a passive navigation task was used to establish an altitude which would provide adequate training with a safety margin, the types of terrain or other features which should be used for checkpoint identification, and the effect of daylight exposure to a route on subsequent navigation performance. Using Experiment 1 as a building block, Experiment 2 tested the effects on active navigation performance of light level, type of map, and order in which light level was experienced. Multiple step-wise linear regression was used to determine associations among the variables and provided an accounting of the variance attributable to each variable of interest. It was concluded that unaided vision navigation is possible at illumination levels as low as .0002 foot candles. Instructional programs must consider restrictions to visibility, map type, proper preflight planning, adequate dark adaptation, a standardized intra-cockpit phraseology, and should use natural terrain features with vertical relief for checkpoint identification. GRA

N80-30289# Analytic Sciences Corp., Reading, Mass.
DEVELOPMENT OF LORAN-C DATA COLLECTION AND ANALYSIS PROCEDURES Final Report, Dec. 1979 - Feb. 1980
Leon M. DePalma, Edward A. Sohoen, and Stephen F. Donnelly Mar. 1980 174 p refs
(Contract DOT-FA79WA-4271)
(AD-A086683; TASC-TR-1021-1; FAA-RD-80-48) Avail: NTIS HC A08/MF A01 CSCL 17/7

A unified data collection and analysis plan to support NAFEC and the FAA in the assessment of Loran-C as either a replacement for or supplement to the current network of VOR/DMEs is presented. This effort focused on four specific areas: Developing mathematical models of temporal variations in Loran-C signal phase and amplitude; Developing data collection procedures to enable an assessment of the accuracy and adequacy of proposed models; Defining a data analysis plan that will enable maximum

use of the data collected in identifying parameters of the proposed models and cause and effect relationships of Loran-C temporal variations; and Defining a plan for the design of a data management system for the storage and maintenance of collected data and an efficient interface for the data analysis programs. The plans and models provide the necessary structure for the data collection and analysis effort anticipated to commence early in 1980. Subsequent analysis of the Loran-C data will validate the models and dictate any modifications of the plans. GRA

N80-30290# Naval Postgraduate School, Monterey, Calif.
POSITION DETERMINATION WITH LORAN-C TRIPLETS AND THE HEWLETT-PACKARD HP-67/97 PROGRAMMABLE CALCULATORS
Rex H. Shudde Mar. 1980 55 p refs
(NR Proj. 128-217)
(AD-A086823: NPS55-80-010) Avail: NTIS
HC A04/MF A01 CSCL 17/7

This report presents an algorithm and HP-67/97 programs for position determination with Loran-C chains. Operational data cards are prepared in advance for Loran-C triplets. Position determination is performed using a single program card and an appropriate operational data card. GRA

N80-30291# Naval Postgraduate School, Monterey, Calif.
AN ALGORITHM FOR POSITION DETERMINATION USING LORAN-C TRIPLETS WITH A BASIC PROGRAM FOR THE COMMODORE 2001 MICROCOMPUTER
Rex H. Shudde Mar. 1980 38 p refs
(NR Proj. 128-217)
(AD-A086790: NPS55-80-009) Avail: NTIS
HC A03/MF A01 CSCL 17/7

An algorithm for position determination using Loran-C triplets and an implementation of the algorithm in the BASIC language of the Commodore 2001 microcomputer are presented. Modifications of the geodesic direct solution and reverse solution algorithms of P. D. Thomas are also presented; these modifications eliminate all the special positioning and quadrant determination requirements of the original algorithms. GRA

N80-30292# Coast Guard, Washington, D.C.
COMMUNICATIONS REQUIREMENTS FOR A LORAN-C POSITION MONITORING SYSTEM FOR VTS VALDEZ, ALASKA Final Report
T. M. Drown Jun. 1980 46 p refs
(AD-A087199: USCG-D-36-80) Avail: NTIS
HC A03/MF A01 CSCL 17/7

The Coast Guard is investigating alternative means to provide increased surveillance capability in its Vessel Traffic Service (VTS) at Valdez, Alaska. The requirement is to extend active position monitoring of ships throughout Prince William Sound. One method of surveillance is to transmit Loran-C time differences from each ship to VTS Valdez for display and storage. This document defines the requirements for a Loran-C position monitoring system using the existing VHF-FM communication network. GRA

N80-30293# National Telecommunication Information Administration, Boulder, Colo. Inst. for Telecommunication Sciences.
POWER LINE CARRIER RADIATION AND THE LOW-FREQUENCY AERONAUTICAL RADIO COMPASS Final Report
William A. Kissick May 1980 137 p refs
(Contract DOT-FA79WAI-023)
(AD-A087126: FAA-RD-80-31) Avail: NTIS
HC A07/MF A01 CSCL 17/3

The power line carrier is a telecommunication technique widely used by the power utilities for communication and telemetry. This system uses the power lines as a propagation medium and operates largely in the LF band. Potential for interference to an aeronautical radio compass operating in the 190-535 kHz aeronautical radio-navigation band exists. The purpose of this work was to examine that potential for interference. Laboratory measurements of radio compass receivers were made. These results indicate that 44 to 54 dBu of undesired signal or an undesired-to-desired signal ratio of 4 to 10 dB was required to cause measurable radio compass bearing errors, depending on the type of receiver. An airplane equipped with a spectrum analyzer/data recording system was used to make power line carrier radiation measurements over two selected power lines in Tennessee. The results indicate that, for the limited measurements taken, radio compass bearing errors could be caused by power line carrier radiation for an injected carrier power of 4 W. The distance and height dependence of the power line carrier radiation is discussed. GRA

N80-30294# National Technical Information Service, Springfield, Va.
AIR TRAFFIC CONGESTION AND CAPACITY. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Apr. 1980
Guy E. Habercom, Jr. Jun. 1980 194 p Supersedes NTIS/PS-79/0594; NTIS/PS-78/0598 (PB80-811052; NTIS/PS-79/0594; NTIS/PS-78/0598)
Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 01E

Present and predicted air traffic density and capacity, both enroute and in airport environments, is analyzed in these research reports. Terminal area scheduling, runway queueing, and airspace regulation are discussed. This updated bibliography contains 186 abstracts, 14 of which are new entries to the previous edition. GRA

N80-30295# National Ocean Survey, Rockville, Md. Coastal Mapping Div.
FORMULAS FOR POSITIONING AT SEA BY CIRCULAR, HYPERBOLIC, AND ASTRONOMIC METHODS
James Collins Feb. 1980 36 p refs
(PB80-184757; NOAA-TR-NOS-81; NOAA-80040101) Avail: NTIS HC A03/MF A01 CSCL 17G

Today's positioning of a vessel is accomplished by using either hyperbolic (LORAN), circular (Raydist), celestial, or satellite navigation systems. The use of these systems with onboard computers often has created problems for the navigator and computer programmer ships' positions. This report is an attempt to clarify and simplify the formulas and procedures required to correctly compute the position of a vessel on the high seas. GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also 18 Spacecraft Design, Testing and Performance and 39 Structural Mechanics.

N80-30296*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
CRASH TESTS OF FOUR IDENTICAL HIGH-WING SINGLE-ENGINE AIRPLANES
Victor L. Vaughan, Jr. and Robert J. Hayduk Aug. 1980 70 p refs
(NASA-TP-1699; L-13076) Avail: NTIS HC A04/MF A01 CSCL 01C

Four identical four place, high wing, single engine airplane specimens with nominal masses of 1043 kg were crash tested at the Langley Impact Dynamics Research Facility under controlled free flight conditions. These tests were conducted with nominal velocities of 25 m/sec along the flight path angles, ground contact pitch angles, and roll angles. Three of the airplane specimens were crashed on a concrete surface; one was crashed on soil. Crash tests revealed that on a hard landing, the main landing gear absorbed about twice the energy for which the gear was designed but sprang back, tending to tip the airplane up to its nose. On concrete surfaces, the airplane impacted and remained in the impact attitude. On soil, the airplane flipped over on its back. The crash impact on the nose of the airplane, whether on soil or concrete, caused massive structural crushing of the forward fuselage. The liveable volume was maintained in both the hard landing and the nose down specimens but was not maintained in the roll impact and nose down on soil specimens. Author

N80-30297# Douglas Aircraft Co., Inc., Huntington Beach, Calif.
EVALUATION OF THE IMPACT OF TOWING DC-9 TRANSPORT AIRPLANES AT BOSTON-LOGAN AIRPORT Final

Report, Sep. 1978 - Oct. 1979
E. A. Hoover May 1980 121 p
(Contract DOT-FA78WA-4198)
(AD-A086864; FAA-NA-80-23) Avail: NTIS
HC A06/MF A01 CSCL 01/2

This report summarizes an investigation to determine the impact of the proposed revisions to airport rules at Boston-Logan International Airport regarding ground movement of aircraft by towing in lieu of taxiing as it affects the fatigue life of the DC-9 aircraft. Tests were conducted using an instrumented tow bar to determine the range of loads which could be expected to occur in service. These loads were then incorporated into a loads model which represents the Boston-Logan towing regime. This loads model was then utilized to perform analysis on the DC-9 nose landing gear and its support structure to determine the fatigue effects. Cost estimates of additional testing, inspection and replacement of affected parts is provided. The results of this investigation indicate that several nose landing gear components could be seriously affected depending upon the degree of exposure to the additional towing at Boston and the number of flights already accumulated by the part at the time the additional towing is initiated at Boston. The immediate effect on these components could be minimized by a redistribution of aircraft within the airline fleet to reduce the exposure of high-time parts of the Boston towing regime. GRA

N80-30298# Systems Control, Inc., Palo Alto, Calif.
ANALYSIS OF T-2C HIGH ANGLE OF ATTACK FLIGHT TEST DATA WITH NONLINEAR SYSTEM IDENTIFICATION METHODOLOGY Final Report, 3 Apr. 1972 - 31 May 1978
James H. Vincent, W. Earl Hall, Jr., and Jeff G. Bohn Mar. 1980 90 p refs
(Contract N00014-72-C-0328)
(AD-A086327; ONR-CR-212-259-1F) Avail: NTIS
HC A05/MF A01 CSCL 01/3

This study represents one of the first thorough applications of advanced nonlinear system identification techniques to the problem of determining aircraft aerodynamic characteristics in the maximum-lift flight regime, and has produced results confirming the ability of these methods to develop realistic and useful dynamics models for flight test data and to provide a valuable guide for data acquisition system specification in future flight test programs. This study also demonstrated the value of employing wind tunnel data and theoretical (or empirical) aerodynamic analyses during the model structure determination stage in order to begin with a basic familiarity with the nature of nonlinearities to be encountered. GRA

N80-30299# Boeing Vertol Co., Philadelphia, Pa. Applied Technology Lab.
DESIGN, DEVELOPMENT, AND FLIGHT DEMONSTRATION OF THE LOADS AND STABILITY CHARACTERISTICS OF A BEARINGLESS MAIN ROTOR Final Report, Jun. 1976 - Oct. 1979
Peter G. C. Dixon Jun. 1980 162 p refs
(Contract DAAJ02-76-C-0026; DA Proj. 1F2-63211-D-157)
(AD-A086754; USAAVRADCOM-TR-80-D-3) Avail: NTIS
HC A08/MF A01 CSCL 01/3

The successful design, development, bench and whirl testing, and flight demonstration of the loads and stability characteristics of a bearingless main rotor (BMR) on the BO-105 helicopter were accomplished. The initial tests indicated that ground resonance damping was inadequate. For this program, a minimal modification, the stiffening of the aircraft skid landing gear, provided adequate damping for the continuation of the program. The BMR/BO-105 had similar air resonance to the baseline BO-105, except at low collective pitch settings where the BMR had lower but sufficient damping. Vibration levels were generally similar to the baseline, but in some regimes were higher. Maneuvering stability showed a significant improvement and other flight characteristics were similar to those of the standard BO-105. The level flight speed was limited only by power available and the 35-hr flight test program was not limited by structural characteristics. The feasibility of helicopter bearingless main rotors has thus been demonstrated. Understanding of the loads distribution in the two-beam lag/flap/torsion flexure at the blade root of this configuration needs improvement. Use of Froude scaled model wind tunnel testing accurately predicted the flight aeromechanical stability characteristics of the BMR; however, the analytical stability prediction methodology, although sufficiently accurate in hover, requires improvement and expansion into the forward flight modes. GRA

N80-30300# Aeronautical Research Labs., Melbourne (Australia).
CALIBRATION OF MIRAGE MAIN UNDERCARRIAGE TO DETERMINE WHEEL LOADS FROM MEASURED STRAINS
K. C. Watters and P. Atcliffe Jul. 1979 60 p refs
(AD-A086721; ARL/Struc-TM-300; AR-001-745) Copyright. Avail: NTIS HC A04/MF A01 CSCL 01/3

The port and starboard legs of a test main undercarriage of the Mirage IIIO have each been instrumented with six independent strain gauges and a potentiometer to measure oleo deflection. Calibration tests were performed in which components of the ground-to-wheel load were applied to each leg, both singly and in combination, and, from the measured strains, calibration parameters were derived. In order to determine wheel load components from measured strains, an iterative method of inverting the non-linear set of equations formed from the calibration parameters was developed. It was found that, due to the insensitive response of any gauge to the vertical load component, the equations were ill-conditioned, with calculated load components being very sensitive to changes in the measured strains. GRA

N80-30301# Aeronautical Research Labs., Melbourne (Australia).
FATIGUE DAMAGE ESTIMATION FOR THE BAeA AIRCRAFT FATIGUE DATA ANALYSIS SYSTEM
Robert C. Fraser Aug. 1979 58 p
(AD-A086470; ARL/Struc-TM-297) Copyright. Avail: NTIS
HC A04/MF A01 CSCL 01/3

The estimation of the fatigue damage from the strain range pair data generated by the airborne component of the BAeA Aircraft Fatigue Data Analysis System is described. GRA

N80-30302# Boeing Vertol Co., Philadelphia, Pa.
EVALUATION OF FORGED HELICOPTER COMPONENTS PROCESSED WITH CONTROLLED SOLIDIFICATION AND THERMAL MECHANICAL TREATMENTS Final Report, Dec. 1976 - Jun. 1980
William L. Weiss Jun. 1980 76 p refs
(Contract DAAG25-77-C-0015)
(AD-A086818; D210-11524-1; USAAVRADCOM-TR-80-F-6)
Avail: NTIS HC A05/MF A01 CSCL 11/6

A four task program was conducted to provide information for evaluating helicopter dynamic system components fabricated from aluminum alloy forgings produced with advanced processing techniques. Components produced with the advanced techniques, involving intermediate thermal-mechanical treatment of ingots, were tested side-by-side with conventionally produced components. Tests were conducted to determine fatigue strength and damage tolerance characteristics of the components. GRA

N80-30303# Lockheed-California Co., Burbank.
EVALUATION OF THE IMPACT OF TOWING THE L-1011 AIRPLANE AT BOSTON-LOGAN AIRPORT Final Report, Oct. 1978 - Aug. 1979
Max A. Gamon May 1980 113 p refs
(Contract DOT-FA78WA-4199)
(AD-A086977; LR-29190; FAA-NA-80-24) Avail: NTIS
HC A06/MF A01 CSCL 01/3

Results of a research program to determine the impact of towing transport airplanes at Boston-Logan Airport are presented. This study includes the measurement of actual towing loads during airline operations with the L-1011 at Los Angeles International Airport and Dorval, Quebec. The measured towing loads were obtained with an instrumented towbar and portable data recording package. Towing loads were also measured during controlled test conditions at Palmdale using the flight-test L-1011 airplane. A fatigue load spectrum representing ground maneuvering including the effects of extended towing was developed. Stress analysis of the nose landing gear and back-up structure was performed using the load spectrum representing extended towing at Boston-Logan. The results indicate that the proposed extended towing operations do not cause a reduction of fatigue life of the nose gear to below the design life for the L-1011. A discussion of alternate towing concepts is presented, and limiting condi-

tions are defined to ensure acceptable operational safety during extended towing. GRA

N80-30304# Analytic Sciences Corp., Reading, Mass.
A PLAN FOR DEVELOPING AND VALIDATING A GUN SYSTEM DESIGN TRADE-OFF METHODOLOGY Final Report, Jun. 1979 - Feb. 1980
Charles F. Price and Jang G. Lee 15 Feb. 1980 44 p refs
(Contract DAAK10-79-C-0213)
(AD-A087239; AD-E400432; TASC-TR-1640-1; ARSCD-CR-80008) Avail: NTIS HC A03/MF A01 CSCL 19/5

Procedures are described for validating a Helicopter Weapon Simulation Model (HWSSM) using data collected from Army's recent Air-to-Air Self Defense Test (AASDT), and for integrating the HWSSM with a gun system sizing model to compute system weight as a function of the basic performance parameters. These parameters include firing interval, probability-of-hit or probability-of-kill, the types of engagements, and the number of engagements of each type per mission. These procedures will provide the Army with an overall methodology for conducting airborne gun system design tradeoff studies. GRA

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation and 35 Instrumentation and Photography*.

N80-30305*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SIMULATION DEVELOPMENT AND EVALUATION OF AN IMPROVED LONGITUDINAL VELOCITY VECTOR CONTROL WHEEL STEERING MODE AND ELECTRONIC DISPLAY FORMAT
George G. Steinmetz Aug. 1980 97 p refs
(NASA-TP-1664; L-13435) Avail: NTIS HC A05/MF A01 CSCL 01D

Using simulation, an improved longitudinal velocity vector control wheel steering mode and an improved electronic display format for an advanced flight system were developed and tested. Guidelines for the development phase were provided by test pilot critique summaries of the previous system. The results include performances from computer generated step column inputs across the full airplane speed and configuration envelope, as well as piloted performance results taken from a reference line tracking task and an approach to landing task conducted under various environmental conditions. The analysis of the results for the reference line tracking and approach to landing tasks indicates clearly detectable improvement in pilot tracking accuracy with a reduction in physical workload. The original objectives of upgrading the longitudinal axis of the velocity vector control wheel steering mode were successfully met when measured against the test pilot critique summaries and the original purpose outlined for this type of augment control mode. R.K.G.

N80-30306# Smiths Industries, Inc., Clearwater, Fla. Aviation Div.
RELIABILITY AND MAINTAINABILITY IMPROVEMENT PROGRAM FOR THE AV-8 A/TAV-8A HARRIER HEAD-UP DISPLAY SET. VOLUME 1: MODIFICATIONS TO DIGITAL DISPLAY INDICATOR IP-1351/AVQ-30(V) Final Engineering Report, 1978 - 1980
Richard W. Lowrie 1 May 1980 18 p
(Contract N00019-77-A-0350)
(AD-A085309; SI-1003-Vol-1; NADC-78080-60-Vol-1) Avail: NTIS HC A02/MF A01 CSCL 14/2

Modifications were made to the head-up display unit on the AV-8A aircraft, to improve reliability. The modifications consisted of substituting a quick release dual combiner for the servo driven single combiner, providing circuit protection against high voltage insulation breakdown, providing BIT-fail format indication in Test Mode 1, and U.S. sourcing of all components. GRA

N80-30307# Smiths Industries, Inc., Clearwater, Fla. Aviation Div.
RELIABILITY AND MAINTAINABILITY IMPROVEMENT PROGRAM FOR THE AV-8 A/TAV-8A HARRIER HEAD-UP DISPLAY SET. VOLUME 2: MODIFICATIONS TO DISPLAY SET CONTROL, C10626/AVS-30(V) Final Engineering Report, 1978 - 1980
Richard W. Lowrie 1 May 1980 15 p
(Contract N00019-77-A-0350)
(AD-A085310; SI-1002-Vol-2; NADC-78080-60-Vol-2) Avail: NTIS HC A02/MF A01 CSCL 14/2

Modifications were made to the pilots control unit for the head-up display on the AV-8A aircraft, to improve reliability. The modifications consisted of a new toggle switch designed to resist breakage or bending of the toggle arm, and new assembly instructions to prevent loosening or loss of push button covers or threaded components. GRA

N80-30308# Army Research Inst. for the Behavioral and Social Sciences, Alexandria, Va. Manpower and Educational Systems Technical Area.
HELICOPTER ELECTRO-OPTICAL SYSTEM DISPLAY REQUIREMENTS. 2: PERFORMANCE OF HELICOPTER PILOTS WHEN USING A LOW-LIGHT-LEVEL TELEVISION SYSTEM DURING SIMULATED NAP-OF-THE-EARTH FLIGHT
Aaron Hyman, Richard M. Johnson, and Paul A. Gade Mar. 1980 21 p
(DA Proj. 2Q1-62722-A-765)
(AD-A086855; ARI-TR-442) Avail: NTIS HC A02/MF A01 CSCL 01/2

Previous ARI research has shown that pilots feel they can successfully use a low light level television system as an aid in night nap-of-the-earth (NOE) flight, even when the highlight luminance of its display is as little as 0.06 footlambert (fL). Videotaped presentations were used in this prior research, and estimations of the lowest usable display luminance were established on the basis of pilot judgment. The present experiment was designed to provide more objective evidence for determining the utility of such low luminance displays when they are used as aids in night NOE flight. Each of 24 Army helicopter pilots made 24 simulated flights over a highly realistic three dimensional terrain model as generated from an optical probe used in conjunction with an SIT television camera. The results showed that pilots had fewer crashes when using a larger display. All pilots flew as well with displays set so that highlight luminance was about 0.05 fL as they did with displays set so highlight luminance was about 0.2 fL. This report discusses the implications of these results for designing a usable low light level television system for night NOE flight. GRA

N80-30309# Hughes Aircraft Co., Culver City, Calif. Design Effectiveness Operations.
NONOPERATING FAILURE RATES FOR AVIONICS STUDY Final Technical Report, Sep. 1977 - Mar. 1979
George A. Kern, Steve S. Tung, Irving Quart, and Kam L. Wong Griffiss AFB, N.Y. RADC Apr. 1980 151 p refs
(Contract F30602-77-C-0187; AF Proj. 2338)
(AD-A087048; HAC-FR-79-70-1190R; RADC-TR-80-136) Avail: NTIS HC A08/MF A01 CSCL 14/4

This report presents the results of a study of the nonoperating failure rates of USAF avionic equipments. Quantitative assessment data on 26 different equipment/aircraft applications are included. The nonoperating failure rates as determined by three different methods utilizing Air Force maintenance data were measurably significant. On average, MTBF assessment results are improved by 22% when nonoperating failures are excluded from operational MTBF assessments. Average operating to nonoperating failure rate ratios for the equipments investigated ranged from 41 to 188. Comparisons between several reliability prediction methods and operational reliability levels achieved are included. Based on the six equipment types analyzed, it is concluded that field nonoperating failure rates cannot be predicted to a reasonable degree of accuracy by using any of the established prediction methods. GRA

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N80-30310*# General Electric Co., Cincinnati, Ohio. Aircraft Business Group.
ENGINE CYCLE STUDIES PROGRAM Final Report, Sep. 1978 - Oct. 1979
R. D. Allan, J. E. Johnson, W. Joy, R. H. Brown, and H. J. Barrial Aug. 1980 176 p refs
(Contract NAS3-21388)
(NASA-CR-159500; R80AEG428) Avail: NTIS HC A09/MF A01 CSCL 21E

The double bypass, variable cycle engine (VCE) used as the propulsion system for a Mach 2.4 cruise supersonic commercial transport was examined in the following areas: (1) the acoustic and performance payoffs of the high flow mode of the double bypass VCE; (2) possible cycle improvements for noise; (3) manufacturing cost, reliability and maintainability of the VCE compared to other engine concepts; (4) an assessment of the performance and economic payoffs of the features used in the double bypass VCE. The high flow capability of the double bypass VCE did show acoustic and performance payoffs both with unsuppressed and with mechanically suppressed coannular exhaust systems. At lower noise goals, changes to the baseline VCE cycle improved takeoff gross weight for a design version by up to 4%. The double bypass feature of the VCE provided performance and acoustic flexibility that resulted in lower takeoff gross weight for all noise levels, utilizing unsuppressed coannular nozzle, suppressed coannular nozzle, and single stream fully suppressed nozzle. The manufacturing cost, reliability, and maintainability of the double bypass VCE compares favorably with the simpler concepts studied (within 1 to 5.5%). L.F.M.

N80-30311# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.
HIGH ENERGY X-RAY STUDY Final Report, Jan. 1978 - Feb. 1979
Malcolm K. Lewis Jun. 1980 204 p refs Prepared in cooperation with Lockheed Missiles and Space Corp., Palo Alto, Calif., and Varian Associates, Inc., Palo Alto, Calif.
(Contract F40600-78-C-0001)
(AD-A086279; AEDC-TR-79-53) Avail: NTIS HC A10/MF A01 CSCL 14/2

This study program investigated the feasibility, and developed a conceptual design, for an analytical/diagnostic X-ray system. This system would be used in existing AEDC test cells and would provide a capability to internally examine turbine engines and solid propellant rocket motors while operating under simulated altitude conditions. Diagnostic X-ray capabilities in each Test cell -- J-1/J-2, C-1/C-2, and J-5 -- were studied, and recommendations made. The participating contractors each developed conceptual plans for recommended equipment including the X-ray source, film detector, and positioning components. In addition, test cell environment, portability/survivability, cell modifications, personnel safety/radiation shielding and equipment standardization were studied, and recommendations were made. GRA

N80-30312# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio. Materials Behavior Branch.
VIBRATIONS OF A COMPRESSOR BLADE WITH SLIP AT THE ROOT Final Report, Nov. 1975 - Jun. 1979
David I. G. Jones Apr. 1980 144 p refs
(AF Proj. 2418)
(AD-A086852; AFWAL-TR-80-4003) Avail: NTIS HC A07/MF A01 CSCL 21/5

A simple discrete analytical model is developed to represent the vibration response behavior of a jet engine compressor or turbine blade, primarily in the fundamental mode, allowing for slip at the root. The analysis is compared with experiment, and agreement is found to be satisfactory, indicating that some of the phenomena involved can be modeled in a simple way. GRA

N80-30313# Pratt and Whitney Aircraft, West Palm Beach, Fla. Government Products Div.
ADVANCED COMBUSTION SYSTEMS FOR STATIONARY GAS TURBINE ENGINES. VOLUME 4: COMBUSTOR VERIFICATION TESTING, ADDENDUM Final Report, Jul. - Oct. 1979
Robert M. Pierce, Clifford E. Smith, and B. S. Hinton Jan. 1980 119 p refs
(PB80-179849; FR-11405-Vol-4; EPA-600/7-80-017D-Vol-4)
Avail: NTIS HC A06/MF A01 CSCL 21E

Tests to evaluate the performance of the combustor on heavy fuels such as petroleum or shale residual oil and solvent refined coal (SRC) are described. Results from the tests show that all exhaust emission goals were met while burning three test fuels: a middle-cut distillate SRC, a residual shale oil, and an Indonesian/Malaysian residual oil. It was also demonstrated that the exhaust emission goals were met when operating a RB/QQ combustor at a high turbine inlet temperature (1426 C design) firing No. 2 fuel oil. GRA

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N80-30314# Lear Siegler, Inc., Grand Rapids, Mich. Instrument Div.
FEASIBILITY STUDY FOR INTEGRATED FLIGHT TRAJECTORY CONTROL FIGHTER Final Report, Jun. 1977 - Jun. 1979
Gregory L. Comegys, Leroy Addis, Jeffrey R. Ring, and Ronald VanWieren Wright-Patterson AFB, Ohio AFFDL Nov. 1979 311 p
(Contract F33615-77-C-3025; AF Proj. 2403)
(AD-A084784; ID-02R-0679; AFFDL-TR-79-3123) Avail: NTIS HC A14/MF A01 CSCL 09/2

The proliferation of increasingly sophisticated enemy military forces in the past decade, and the ability to quickly apply those forces anywhere in the world, has stressed the importance of a demonstrated deterrent capability. This capability should combine rapid reaction with the ability to apply the appropriate force at the appropriate place. Strategic and tactical power, global mobility and precise, well-ordered strike capability are necessary parts of the required capability. Communication and accurate time-space coordination will be required capabilities. The ability to strike at night and in adverse weather and to successfully redirect to a higher priority target, all in a well-coordinated manner, will help to offset the superiority of enemy aircraft numbers. The Integrated Flight Trajectory Control (IFTC) program has been concerned with solving these problems. The solution involves the development of a system which adds flight management capabilities through the use of digital computers to integrate guidance and control with control and display, navigation, weapon delivery, data-link systems and other on-board sensors. Following system development, the concept was demonstrated by realtime, man-in-the-loop simulation in the LSI Hybrid Computing Facility. GRA

N80-30315# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
THE USAF STABILITY AND CONTROL DIGITAL DATCOM. VOLUME 1: USER'S MANUAL Final Report, Aug. 1977 - Nov. 1978
John E. Williams and Steven R. Vukelich Wright-Patterson AFB, Ohio AFFDL Apr. 1979 313 p refs Supersedes AFFDL-TR-76-45-Vol-1 3 Vol.
(Contract F33615-77-C-3073; AF Proj. 8219)
(AD-A086557; AFFDL-TR-79-3032-Vol-1; AFFDL-TR-76-45-Vol-1) Avail: NTIS HC A14/MF A01 CSCL 09/2

This report describes a digital computer program that

calculates static stability, high lift and control, and dynamic derivative characteristics using the methods contained in the USAF Stability and Control Datcom (revised April 1976). Configuration geometry, attitude, and Mach range capabilities are consistent with those accommodated by the Datcom. The program contains a trim option that computes control deflections and aerodynamic increments for vehicle trim at subsonic Mach numbers. Volume 1 is the user's manual and presents program capabilities, input and output characteristics, and example problems. The program is written in ANSI FORTRAN IV. The primary deviations from standard FORTRAN are Namelist input and certain statements required by the CDC compilers. Core requirements have been minimized by data packing and the use of overlays. User oriented features of the program include minimized input requirements, input error analysis, and various options for application flexibility. GRA

N80-30316# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
THE USAF STABILITY AND CONTROL DIGITAL DATCOM. VOLUME 2: IMPLEMENTATION OF DATCOM METHODS Final Report, Aug. 1977 - Nov. 1978
John E. Williams and Steven R. Vukelich Wright-Patterson AFB, Ohio AFFDL Apr. 1979 161 p refs Supersedes AFFDL-TR-76-45-Vol-2 3 Vol.
(Contract F33615-77-C-3073; AF Proj. 8219)
(AD-A086558; AFFDL-TR-79-3032-Vol-2; AFFDL-TR-76-45-Vol-2) Avail: NTIS HC A08/MF A01 CSCL 09/2

This report describes a digital computer program that calculates static stability, high lift and control, and dynamic derivative characteristics using the methods contained in the USAF Stability and Control Datcom. Configuration geometry, attitude, and Mach range capabilities are consistent with those accommodated by the Datcom. The program contains a trim option that computes control deflections and aerodynamic increments for vehicle trim at subsonic Mach numbers. Volume 2 describes program implementation of Datcom methods. The program is written in ANSI FORTRAN IV. The primary deviations from standard Fortran are Namelist input and certain statements required by the CDC compilers. Core requirements have been minimized by data packing and the use of overlays. User oriented features of the program include minimized input requirements, input error analysis, and various options for application flexibility. GRA

N80-30317# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
THE USAF STABILITY AND CONTROL DIGITAL DATCOM. VOLUME 3: PLOT MODULE Final Report, Aug. 1977 - Nov. 1978
John E. Williams, Steven R. Vukelich, S. C. Murray, G. J. Mehlick, and T. B. Sellers Wright-Patterson AFB, Ohio AFFDL Apr. 1979 78 p refs 3 Vol.
(Contract F33615-77-C-3073; AF Proj. 8219)
(AD-A086559; AFFDL-TR-79-3032-Vol-3) Avail: NTIS HC A05/MF A01 CSCL 09/2

This report describes a digital computer program that calculates static stability, high lift and control, and dynamic derivative characteristics using the methods contained in the USAF Stability and Control Datcom. Configuration geometry, attitude, and Mach range capabilities are consistent with those accommodated by the Datcom. The program contains a trim option that computes control deflections and aerodynamic increments for vehicle trim at subsonic Mach numbers. Volume 3 discusses a separate plot module for Digital Datcom. The program is written in ANSI FORTRAN IV. The primary deviations from standard FORTRAN are Namelist input and certain statements required by the CDC compilers. Core requirements have been minimized by data packing and the use of overlays. User oriented features of the program include minimized input requirements, input error analysis, and various options for application flexibility. GRA

N80-30318# Aeronautical Research Labs., Melbourne (Australia).
SEA KING MK. 50 HELICOPTER FLIGHT CONTROL SYSTEM: A MATHEMATICAL MODEL OF THE AFCS (ASW) MODE
Christopher R. Guy Jun. 1979 44 p refs
(AD-A086969; ARL/Aero-Note-393) Avail: NTIS HC A03/MF A01 CSCL 01/4

A mathematical model for the anti-submarine warfare (ASW) mode of the automatic flight control system (AFCS) for the Sea King Mk. 50 helicopter is presented. An outline of the ASW mode facilities is given first, followed by a description of the mathematical model, which includes a representation of each major element of the aircraft system. GRA

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

No abstracts in this category.

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration*.

N80-30319*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE TELECOMMUNICATIONS AND DATA ACQUISITION REPORT Progress Report, May - Jun. 1980
N. A. Renzetti 15 Aug. 1980 121 p refs
(Contract NAS7-100)
(NASA-CR-163431; TDA-PR-42-58) Avail: NTIS HC A06/MF A01 CSCL 17B

Deep Space Network progress in flight project support, tracking and data acquisition research and technology, network engineering, hardware and software implementation, and operations is documented. In addition, developments in Earth based radio technology as applied to geodynamics, astrophysics, and the radio search for extraterrestrial intelligence are reported. For individual titles, see N80-30320 through N80-30341.

N80-30320*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ACCURATE RADIO POSITIONS WITH THE TIDBINBILLA INTERFEROMETER c17
M. J. Batty (CSIRO, Sydney), D. J. Jauncey (CSIRO, Sydney), P. T. Rayner (CSIRO, Sydney), and S. Gulkis *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 1-5 refs (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 17G

The Tidbinbilla interferometer, designed specifically to provide accurate radio position measurements of compact radio sources in the Southern Hemisphere with high sensitivity using the 26 m and 64 m antennas of the Deep Space Network at Tidbinbilla, near Canberra, is discussed. The instrument also provides high accuracy flux density measurements for compact radio sources. E.D.K.

N80-30321*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE TIDBINBILLA INTERFEROMETER c32
M. J. Batty (CSIRO, Sydney), D. L. Jauncey (CSIRO, Sydney), S. Gulkis, and M. J. Yerbury (Sydney Univ.) *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 6-8 ref (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 17B

A proposal to operate a two element interferometer using the 64 m and 26 m antennas of the Tidbinbilla Deep Space Station is discussed. The instrument is to be operated as a correlation interferometer, the sine and cosine products being

sampled once per second and recorded for later analysis. The receiver systems are currently under development. Preliminary measurements of the delay line and local oscillator systems and the site cables suggest that a phase stability to within about 1 deg should be achievable with temperature control of the receiver packages. E.D.K.

N80-30322*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DIGITAL RECORDING ACQUISITION SUBSYSTEM FOR RADIO INTERFEROMETRY APPLICATIONS IMPLEMENTATION PLAN c35
V. B. Kapoor *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 9-14 (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 14E

The digital recording acquisition subsystem (DRAS) is a wideband digital recording system that can accommodate data sample rates from 0.125 to 8 MHz in binary increments. The implementation of the DRAS for radio interferometry applications in support of the Crustal Dynamics Project is described. The functional and performance characteristics of the equipment and the key aspects of the implementation plan are discussed. E.D.K.

N80-30323*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VLBI SYSTEM FOR WEEKLY MEASUREMENT OF UT1 AND POLAR MOTION: PRELIMINARY RESULTS c17
M. Roth and T. Yunck *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 15-20 refs (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 17G

The DSN implementation of a system for measuring UT1 and polar motion using very long baseline interferometry (VLBI) is currently being tested. The VLBI experiments are being conducted on a weekly basis on each of two intercontinental baselines. During a 17 day period in September 1979, data were obtained for seven consecutive experiments using an early version of that system. Those experiments were used to refine the estimation procedure to be used in the operational system and to provide a preliminary assessment of the performance of the system. E.D.K.

N80-30324*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PROGRESS REPORT ON THE BLOCK 1 VLBI CORRELATOR IMPLEMENTATION c17
J. C. Peterson, J. W. Dillon, and D. H. Rogstad *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 21-23 (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 17G

The Block 1 VLBI Processor Subsystem (VPS) of the Very Long Baseline Interferometry (VLBI) System for the determination of station clock-sync parameters, UT1 and polar motion, and station platform parameters and for use in spacecraft tracking is discussed. The Block 1 VPS performs three basic functions: it receives the 500 kbit/sec video data over the GCF wideband data lines from each of the three DSN 64 m antennas; it cross correlates data; and it performs several postcorrelation data reduction operations on the correlated data including calibration, editing, and parameter estimation. E.D.K.

N80-30325*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
BLOCK 1, PHASE 1 VERY LONG BASELINE INTERFEROMETRY IMPLEMENTATION c17
J. H. Wilcher *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 24-27 ref (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 17G

The Block 1, phase 1 VBLI System, implemented in the Deep Space Network and currently undergoing system testing, is discussed. The system can be characterized as the modification of existing equipment and the addition of new software in the 64 m subnet and the addition of new hardware and software in the Network Operations and Control Center. It is to be operational to support Voyager project navigation requirements and is to provide, on a weekly basis, the information related to station clock synchronization, UT1, and polar motion. E.D.K.

N80-30326*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
NETWORK FUNCTIONS AND FACILITIES c14
N. A. Renzetti *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 28-30 (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 14B

The objectives, functions, and organization of the Deep Space Network are summarized. Deep space station, ground communication, and network operations control capabilities are described. Author

N80-30327*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DSN MONITOR AND CONTROL SYSTEM, MARK III-80 c14
J. G. Lellang *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 31-33 (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 22D

The Deep Space Network monitor and control system, Mark III-80 is described. The major implementations required to evolve from the Mark III-78 to the Mark III-80 configuration are identified. The affected facilities are the deep space stations and the network operations control center (NOCC). At the deep space stations a stand-alone host processor is implemented. Included are software (host software) changes which provide downline loading to the stand-alone host processor from a disc unit of any idle data system computer. At deep space stations with a 34 m antenna, the microwave subsystem is provided with an interface which allows remote configuration selection at the central monitor and control operator's position. In the NOCC, software changes are implemented to provide precision power monitor and GCF monitor displays. M.G.

N80-30328*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PIONEERS 10 THROUGH 12 SUPPORT c14
R. E. Nevarez *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 34-35 (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 22D

The activities of the Deep Space Network in support of the Pioneer 10 and 11 and Pioneer 12 (Pioneer-Venus) Missions from 16 December 1979 through 31 May 1980 are reported. The mission status for each of the spacecraft is also reported. M.G.

N80-30329*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PIONEERS 6 THROUGH 9 SUPPORT c14
R. E. Nevarez *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 36-37 (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 22D

The cruise phases of Pioneer 6 through 9 missions and the operations of the Deep Space Network in supoort of the Pioneer missions are reported for the period of 16 December 1979 through 31 May 1980. Pioneer 6 through 9 are in cruise mode and spacecraft appear to be operating nominally. Pioneer 8 continues to require the 100 kW transmitter from 64 m stations due to the spacecraft's degraded receiver. Difficulties in acquiring a downlink from the Pioneer 6 are discussed. M.G.

N80-30330*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
AUTOMATED FREQUENCY STANDARD STABILITY DATA REDUCTION c60
L. J. Knapp *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 38-40 (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 09B

A design using a medium sized computer, a fiber optic communication link, and a desk top computer to reduce data collected at a remote site for analysis of frequency standard

tests is described. Data generated at the Interim Frequency Standards Test Facility is collected on magnetic tape, which is then transported to a Sigma 5 computer. An Allan variance (two sample variance) is then calculated. The Allan variance (sigma vs tau) is then written to a data file in the Sigma 5. A fiber optic communication link between the Sigma 5 and a desk top computer was designed to transmit data in the Sigma 5 file to the desk top computer. A program was written for the desk top computer that will automatically access the data file in the Sigma 5, process the data and provide a data plot. M.G.

N80-30331*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

SIGNAL TO NOISE RATIO CALCULATION FOR FIBER OPTICS LINKS **c74**

K. Y. Lau *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 41-48 *refs* (For primary document see N80-30319 21-12)

Avail: NTIS HC A06/MF A01 CSCL 20F

The signal to noise ratio (SNR) effect upon the maximum transmission length of a fiberoptic system is discussed. The relationships of different system parameters are discussed. A general formula to obtain the SNR of a single mode fiberoptic system is derived. The SNR attainable with single mode and multimode fiber optics links was calculated from fundamental noise considerations. It was found that for single mode fibers, laser noise dominates the noise contributions for links less than 30 km long, while thermal noise dominates for longer links. Multimode fibers degrade SNR for long links because of intermode dispersion. For frequency standard transmission, as long as the baseband modulation signals are within the bandwidth of the fibers, respectable SNR can be attained with low loss fibers (approximately 1 dB/km) for links as long as 70 km. For wideband transmission SNR is decreased by a factor equal to the ratio of the bandwidth. M.G.

N80-30332*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

INPUT SIGNAL CONDITIONER FOR THE MULTIMEGASYMBOL TELEMETRY SYSTEM FEASIBILITY MODEL **c17**

G. L. Stevens *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 49-58 *ref* (For primary document see N80-30319 21-12)

Avail: NTIS HC A06/MF A01 CSCL 17B

The input signal conditioner portion of the multimegasymbol telemetry demodulator and detector feasibility model is described. The input signal conditioner accepts the 55 MHz wideband IF signal of a Block 4 Deep Space Network receiver and provides selectable bandpass filtering, total power automatic gain control, and frequency translation providing inphase and quadrature outputs at baseband. M.G.

N80-30333*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

USE OF K SUB A-BAND FOR RADIO METRIC DETERMINATIONS **c32**

P. D. Potter *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 59-66 *refs* (For primary document see N80-30319 21-12)

Avail: NTIS HC A06/MF A01 CSCL 20N

The use of K sub A-band to alleviate the radio metric degradation caused by charged particles is discussed. Those aspects of radio metrics which are relevant to the possible future use of K sub A-band deep space to Earth and Earth to deep space links are reviewed. In particular the effects of the Earth ionosphere, troposphere, and solar plasma are examined. It is concluded that, from the standpoint of reducing the harmful effects of charged particles, the use of K sub A-band appears highly desirable. While stability will be a more serious design constraint at K sub A-band than it is at X-band (for example in the ground power amplifier and the spacecraft multiplier stages) this problem is amenable to a state of the art engineering solution. M.G.

N80-30334*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

QUICKLIST: THE BASIS FOR A COMPUTER AIDED LOGIC DESIGN SYSTEM **c33**

W. A. Lushbaugh *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 67-71 (For primary document see N80-30319 21-12)

Avail: NTIS HC A06/MF A01 CSCL 09C

Quicklist, a preprocessor for an existing wire list program that cuts the description of the wire list by about 67 percent over previous methods, is described. Quicklist uses two different methods to shorten the input data. The first of these is the use of parentheses to allow a compact way of describing signal names which increment (or decrement) by one, i.e., typical signal names in a bus. The other method used is the equal sign. Using this symbol in a signal list says that the rest of the signals on that chip are the same as those on the previous chip described. Quicklist is intended to be the basis of a computer aided logic design system. M.G.

N80-30335*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

CONCERNING THE FEASIBILITY OF A REAL TIME SAR DIGITAL PROCESSOR FOR VOIR LOW RESOLUTION IMAGING MODES **c32**

T. K. Truong and R. G. Lipes *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 72-81 *refs* (For primary document see N80-30319 21-12)

Avail: NTIS HC A06/MF A01 CSCL 17I

The feasibility of real time digital processing of synthetic aperture radar data for Venus orbiting imaging radar low resolution modes was investigated. First, it is shown that range migration is not a problem for these modes. Then, under the assumption of no range migration, fast Fourier transform implementations for accomplishing both range and azimuth correlation in real time are shown to be feasible with current technology. R.C.T.

N80-30336*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

FEASIBILITY AND COST STUDY ON VOIR SAR DATA TRANSFER VIA A BENT PIPE LINK **c32**

Y. H. Park and A. M. Goldman, Jr. *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 82-90 (For primary document see N80-30319 21-12)

Avail: NTIS HC A06/MF A01 CSCL 17I

An INTELSAT/DOMSAT double hop bent pipe link for the Venus orbiting imaging radar synthetic aperture radar imaging data transfer from deep space stations 43 and 63 to the Jet Propulsion Laboratory was investigated. The cost for the bent pipe transfer was estimated and compared to that for the planned tape record/airfreight-the-tape transfer method. R.C.T.

N80-30337*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

SPATIAL ACQUISITION OF OPTICAL SOURCES IN THE PRESENCE OF INTENSE INTERFERENCE **c74**

V. A. Vilnrotter *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 91-96 *refs* (For primary document see N80-30319 21-12)

Avail: NTIS HC A06/MF A01 CSCL 20F

The problem of spatially acquiring an optical beacon in the presence of intense optical interference is considered. It is demonstrated that conventional acquisition procedures cannot establish acceptable levels of acquisition probability when competing with strong optical interference without requiring unreasonable amounts of prime power. As a possible solution, it is shown that a more sophisticated acquisition scheme can virtually eliminate the effects of optical interference while requiring only a modest increase in system complexity. Author

N80-30338*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

NAVIGATION NETWORK OPERATIONAL CONSIDERATIONS **c17**

E. Hird *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 97-107 *refs* (For primary document see N80-30319 21-12)

Avail: NTIS HC A06/MF A01 CSCL 17G

The development of the philosophy necessary for the initial operations costing of the three candidate navigation network designs is described. The effect of the need to minimize costs upon the operations and maintenance concepts, the simplification

of operations by adopting the very long base interferometry principle as a basis for the scenarios, and the estimation of the annual load factor based upon an assumed mission set are detailed. Author

N80-30339*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
GROUND COMMUNICATION FACILITY AND NETWORK OPERATIONS CONTROL CENTER RECONFIGURATION c17
D. S. Bremner and C.-K. Hung *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 108-109 *refs* (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 17B

The reconfiguration of the computer facilities in the central communications terminal at the Jet Propulsion Laboratory is discussed. The status of both hardware and software changes are reported. R.C.T.

N80-30340*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
POWER LINE ANOMALIES AS THEY AFFECT THE OPERATION OF A DSN STATION: OVERVIEW c32
T. L. Potter *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 110-113 *refs* (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 20N

The problem of providing a sufficiently stable and reliable power source for the equipment in a DSN station is addressed. The potential for the occurrence of damaging commercial power variations is considered with respect to the need for a more precise power source. R.C.T.

N80-30341*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VOYAGER-JUPITER RADIO SCIENCE DATA PAPERS c91
G. S. Levy and G. E. Wood *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 114-115 (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 03B

The reduction and interpretation of the radio science data from the Voyager 1 and 2 encounters of the planet Jupiter and its satellites resulted in the preparation of several papers for publication in the special Voyager-Jupiter issue of the Journal of Geophysical Research. The radio science and tracking systems of the Deep Space Network provide the data which makes this research possible. This article lists submitted papers by title, with their authors and with abstracts of their contents. Author

N80-30342*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SHUTTLE TIME AND FREQUENCY TRANSFER EXPERIMENT
D. W. Allan (NBS), C. O. Alley (Maryland Univ., College Park), R. Decher, R. F. C. Vessot (Smithsonian Astrophysical Observatory), and G. M. R. Winkler (Naval Observatory) Jun. 1980 32 p *refs*
(NASA-TM-78288) Avail: NTIS HC A03/MF A01 CSCL 22A

A proposed space shuttle experiment to demonstrate techniques for global high precision comparison of clocks and primary frequency standards is described. The experiment, using transmitted microwave and pulsed laser signals, compared a hydrogen maser clock onboard the space shuttle with a clock in a ground station in order to demonstrate time transfer with accuracies of 1 nsec or better and frequency comparison at the 10 to the -14th power accuracy level. T.M.

N80-30343*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HALLEY'S COMET 1985-86: A UNIQUE OPPORTUNITY FOR SPACE EXPLORATION
Robert W. Farquhar and William H. Wooden, II Jan. 1980 15 p *refs*
(NASA-TM-80633) Avail: NTIS HC A02/MF A01 CSCL 22A

A coordinated program to explore Halley's comet in 1985 to 86 is proposed. The program employs a variety of observational systems for remote observations and utilizes spacecraft encounters with the comet to obtain in-situ measurements. Included in the observational network are groundbased observatories, the Space Telescope, a Spacelab cometary observatory, small astronomical satellites, and experiments carried on airborne observatories and sounding rockets. It is assumed that a ballistic flythrough technique will be used to carry out the spacecraft encounters. The proposed strategy calls for the simultaneous launch of two spacecraft towards an intercept with Halley in March 1986. Following the Halley encounter one spacecraft is retargeted to intercept comet Borrelly in January 1988, while the other spacecraft proceeds to an encounter with comet Tempel 2 in September 1988. Author

N80-30344*# Engins Matra, Velizy (France). Div. Etudes et Syntheses.
PROJECT MINOS: TECHNICAL STUDY Final Report [PROJET MINOS: ETUDE TECHNIQUE]
P. Bourg, J. Broquet, M. DoMauLam, and P. Rollier Jan. 1979 344 p *In FRENCH; ENGLISH summary*
(Contract CNES-78/0662)
(Rept-601/01) Avail: NTIS HC A15/MF A01

The MINOS project is an advanced study for large scale processing of materials in space, automatically and continously over a time span of 3 years. Concepts for automatic manipulation of materials, automatic supply of materials, and their retrieval from space were examined. A modular space station is proposed devoted mainly to material processing, but also to other missions such as observation and communication. Author (ESA)

N80-30345*# European Space Agency, Paris (France).
[REPORT ON EUROPEAN SPACE ACTIVITIES, 1979] Annual Report
1979 175 p *refs* Original contains color illustrations
Avail: NTIS HC A08/MF A01

The year's activities are outlined including the scientific program, remote sensing, telecommunications, Spacelab, Ariane, satellite operations and data processing. Scientific and technical information services, ground facilities, administration, and budget are also discussed. Author (ESA)

N80-30346*# European Space Agency, Paris (France).
GIOTTO: COMET HALLEY FLYBY. REPORT ON THE PHASE A STUDY
14 May 1980 87 p
(ESA-SCI(80)-4) Avail: NTIS HC A05/MF A01

The use of a GEOS type satellite, launched either by Ariane or by a Thor-Delta rocket, to intercept the nucleus of Halley's Comet close to the nucleus was studied. Present knowledge concerning comets was reviewed. The scientific objectives and a model payload including a lightweight camera, spectrometers, instruments for analyzing dust and plasma, and a magnetometer are described. A mission description including launch mass and launch windows is presented. Spacecraft structure, system configuration, thermal control, data handling, and power supply were analyzed. Scheduling, for the mission and development planning are proposed. Author (ESA)

N80-30347*# European Space Agency, Paris (France). Space Science Dept.
[REPORT ON EUROPEAN SPACE ACTIVITIES]
W. R. Burke, ed. May 1980 315 p *refs* Presented at 23rd COSPAR Meeting, Budapest, Jun. 1980 Original contains color illustrations
(ESA-SP-1023) Avail: NTIS HC A14/MF A01

The 12 scientific satellites which were launched, and results obtained from analyses of data returned from them are reviewed. Findings are presented from satellites still active, Cos-B, GEOS-1, ISEE, IUE, and GEOS-2. Programs under development are reviewed, including Spacelab, Exosat, International Solar Polar Mission, Space Telescope, Firewheel, Hipparcos, and the Liquid Helium Cryostat. Author (ESA)

N80-30348*# Societe Europeenne de Propulsion, Vernon (France). Dept. Espace.
STUDY ON THE UTILIZATION OF SOLAR ENERGY FOR THE OPERATION OF SPACELAB MATERIAL SCIENCE FURNACES Final Report

M. Robert, ed. and C. Fouche, ed. 1979 110 p refs
(Contract ESA-3787/78 F-FC(SC))
(ESA-CR(P)-1301) Avail: NTIS HC A06/MF A01

User requirements, Spacelab constraints, options for furnace type, sample storage and retrieval, and optics associated with the development of a solar energy system for a materials science furnace are studied. A design is proposed, including mass and dimensions, for an isothermal furnace for metallurgy experiments (temperatures up to 1800 deg). The mirror allows the concentration of 2 kW at the furnace aperture. The system is to be installed on a free flying pallet. Author (ESA)

N80-30348# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
STUDY ON THE UTILIZATION OF SOLAR ENERGY FOR THE OPERATION OF SPACELAB MATERIAL SCIENCE FURNACES Final Report
M. Bader, J. P. Baselt, W. Breitling, H. Lenski, and K. Suttner
24 Oct. 1979 113 p refs
(Contract ESA-3788/78-F-FC(SC))
(DS-ERT-21-79; ESA-CR(P)-1314) Avail: NTIS HC A06/MF A01

The user requirements, possibilities and constraints resulting from the Orbiter/Spacelab vehicle are summarized. The major elements of a solar heating facility are defined and technical solutions for the various components are outlined. Two different concepts are possible: a light concept and heat concept. The heat concept uses a heat storage element and heat pipe furnaces for isothermal, gradient or zone melting processing. It operates in day/night orbits up to temperature of 1250 - 1580 K, depending on the process. In the light concept light transfer in a light guide is discussed, but a more simple system with the furnace directly in the focus is described in detail. This furnace allows zone melting up to 3000 K and an isothermal coversion up to 200 K. For both concepts the technology is available and the usage of solar heating facilities appears very attractive.
Author (ESA)

N80-30350# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany). Electronics Div.
THE ROLE OF COMMAND AND DATA MANAGEMENT SUBSYSTEM (CDMS) IN A FUTURE PAYLOAD OPERATIONS SCENARIO Final Report
O. Neff, H.-J. Moster, and H. Reffel Feb. 1970 210 p refs
(Contract ESA-3906/79-F-HEW(SC))
(ESA-CR(P)-1325) Avail: NTIS HC A10/MF A01

Analysis of payload operation tasks resulted in an autonomous experiment concept. Features of the recommended concept include: experiment specific tasks are to be performed by microcomputers (Dedicated Experiment Processors - DEPs) and not by Command and Data Management Subsystem (CDMS); and development and complete checkout of autonomous experiments (hardware and software) is the principal investigator's responsibility. Based on this concept a payload operations scenario and requirements concerning crew activities, CDMS, and DEPs are defined. Modifications, necessary for the adaptation of CDMS to the concept, are described and include development of the DEP-Experiment Bus Adaptor, implementation of the subsystem computer/experiment computer link, and experiment computer system modifications. It is recommended that support be provided to the principal investigator to reduce experiment development and checkout costs by a DEP instrumentation pool and a CDMS simulation package for experiment checkout. ESA

N80-30351# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
STUDY OF TECHNICAL FEASIBILITY AND COSTING OF BIORACK. VOLUME 1: TECHNICAL REPORT Final Report
H. Braumann, W. Breitling, H. Francois, H. Lenski, P. Schiller, and P. Reusser (Reusser (Peter U.) A.G.) Nov. 1979 134 p
(Contract ESA-3988/79-F-DK(SC))
(ESA-CR(P)-1332-Vol-1) Avail: NTIS HC A07/MF A01

Biorack is designed as a multi-user facility for carrying out biological experiments in Spacelab in the areas of cells, tissues, and micro-organisms. Fourteen proposed life science experiments have provided the basis for the Biorack design which consists of two different types of incubators, a freezer (-20 C minimum) and a glovebox for preservation and fixation techniques, all accommodated in one standard Spacelab single rack. Two each of two types of incubators are included in the Biorack, and operate in the temperature ranges of 27 C to 37 C (type 1) and 2 C to 27 C (type 2). A 35 mm camera, a high power microscope (1250 x), a low power stereo microscope (400 x), a centrifuge (200 g), and the necessary supporting subsystems for power conditioning and distribution, and data acquisition and recording, are included. For the development planning and cost estimation of the Biorack building phase, a low cost approach was adopted, which resulted in a development phase duration of 29 months and an estimated cost of about 5 million AU.
Author (ESA)

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

No abstracts in this category.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also 09 Research Support Facilities (Air).

N80-30352*# Rensselaer Polytechnic Inst., Troy, N. Y. School of Engineering.
DESIGN OF A DYNAMIC TEST PLATFORM FOR AUTONOMOUS ROBOT VISION SYSTEMS
Gary C. Rich Aug. 1980 76 p
(Grant NsG-7369; Contract JPL-954880)
(RPI-TR-MP-69; NASA-CR-163500) Avail: NTIS HC A05/MF A01 CSCL 14B

The concept and design of a dynamic test platform for development and evluation of a robot vision system is discussed. The platform is to serve as a diagnostic and developmental tool for future work with the RPI Mars Rover's multi laser/multi detector vision system. The platform allows testing of the vision system while its attitude is varied, statically or periodically. The vision system is mounted on the test platform. It can then be subjected to a wide variety of simulated can thus be examined in a controlled, quantitative fashion. Defining and modeling Rover motions and designing the platform to emulate these motions are also discussed. Individual aspects of the design process are treated separately, as structural, driving linkages, and motors and transmissions. R.K.G.

N80-30326*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
NETWORK FUNCTIONS AND FACILITIES
N. A. Renzetti *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 28-30 (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 14B

N80-30327*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DSN MONITOR AND CONTROL SYSTEM, MARK III-80
J. G. Leflang *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 31-33 (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 22D

N80-30328*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

PIONEERS 10 THROUGH 12 SUPPORT
R. E. Nevarez *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 34-35 (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 22D

N80-30329*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PIONEERS 6 THROUGH 9 SUPPORT
R. E. Nevarez *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 36-37 (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 22D

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N80-30353 Institut d'Aeronomie Spatiale de Belgique, Brussels.
ARTIFICIAL SATELLITES, LIST FOR 1957 TO 1978 [TABLEAU DES SATELLITES ARTIFICIELS 1975 TO 1978]
J. Vercheval 1979 243 p refs In FRENCH; ENGLISH summary
(Aeronomica-Acta-F-28-1979) Avail: Issuing Activity
Successful launchings up to December 31, 1978 are summarized. A list of satellites is given with a brief description of the missions for the various types of satellites. A chronology of manned space flight is presented. Author (ESA)

N80-30354*# National Aeronautics and Space Administration, Washington, D. C.
MISSION OPERATION REPORT. GEOSTATIONARY OPERATIONAL SATELLITE GOES-D Mission Operation Report
4 Sep. 1980 44 p
(NASA-TM-81123; E-612-80-02) Avail: NTIS HC A03/MF A01 CSCL 22B
Descriptions of the Geostationary Operational Environmental Satellite (GOES-D) mission, spacecraft, launch vehicle, support, management responsibility, and projects costs are presented. The primary objectives are: (1) to launch the GOES-D into a synchronous orbit of sufficient accuracy to enable the spacecraft to provide continuous observations of the atmosphere on an operational basis; (2) to flight test the GOES-D in orbit, and when checked out, turn the spacecraft over to NOAA for operational use; and (3) to demonstrate, validate, and assess the temperature and moisture soundings from the Visible and Infrared Spin Scan Radiometer and Atmospheric Sounder. L.F.M.

N80-30355*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VARIATIONS IN THE NIMBUS-7 SCANNING MULTICHANNEL MICROWAVE RADIOMETER COLD REFERENCE ANTENNA SIGNALS AND TEMPERATURES DURING TWO ORBITAL PERIODS
Per Gloersen, D. J. Cavalieri, and H. V. Soule (OAO Corp., Beltsville, Md.) Aug. 1980 73 p refs
(NASA-TM-81984) Avail: NTIS HC A04/MF A01 CSCL 22B
The observed effects of solar radiance on the Nimbus 7 scanning multichannel microwave radiometer (SMMR) cold reference signal are discussed. Unexpected diurnal responses in this signal sometimes larger than the typical cold reference signal resulted from acquisition of the solar disc. Solar heating of the SMMR components as a function of orbital locations was correlated with the cold reference radiances for two sets of sequential orbit six months apart. T.M.

N80-30356# Aerotherm Acurex Corp., Mountain View, Calif.
DEVELOPMENT AND TESTING OF TWO-STAGE HYBRID LAUNCHER Final Report
K. E. Suchsland and J. D. Watson 31 Oct. 1979 173 p refs
(AD-A086268; AD-E300807; ACUREX-FR-79-19/AS(7386))
Avail: NTIS HC A08/MF A01 CSCL 16/1
This report summarizes the development to date of a 1/4-scale launcher designed to launch a 7.2 kg model at a 6.1 km/sec in full scale. The hybrid launcher design principles are reviewed. Projected performance shows launch masses within soft-launch constraints that are 3 to 4 times larger than possible by using a conventional two-stage launcher. The results of component development tests leading to the subscale demonstration are presented. The importance of tungsten liners for obtaining the projected performance is emphasized, and the results of liner bond developments are described. GRA

N80-30357# Naval Ocean Systems Center, San Diego, Calif. Avionics Systems Branch.
HIGH TORQUE-TO-INERTIAL SERVO SYSTEM FOR STABILIZING SENSOR SYSTEMS. CANDIDATE SYSTEMS INCLUDE MISSILE GUIDANCE, SURVEILLANCE, AND TRACKING Final Report, Jul. 1979 - Jan. 1980
F. Dale Groutage Apr. 1980 275 p
(AD-A086705; NOSC/TR-527) Avail: NTIS HC A12/MF A01 CSCL 17/7
This is a technical report on the design and development of a high torque-to-inertia servo system for stabilizing a sensor system. The design philosophy leads to a low cost/high performance system. The stabilizing element developed is universal and has application for missile guidance, surveillance, and tracking sensor systems. The servo design is based on math models and is used to develop performance specifications and perform evaluations. GRA

N80-30358# Naval Research Lab., Washington, D. C.
RADIATION DOSE IN SATELLITES AT 1111 KILOMETERS WITH AN INCLINATION OF 63 DEG Interim Report
Mary D. Stemple 16 May 1980 35 p refs
(RR0120141)
(AD-A086779; AD-E000447; NRL-MR-4236) Avail: NTIS HC A03/MF A01 CSCL 22/2
A computer program was written to provide a convenient means of calculating the radiation dose received by a satellite in a specified orbit over a given time period. In this case, the orbit is circular at 1111 km altitude, 63 deg inclination. The input data required are tables of annualized orbit-integrated radiation dose vs. shielding thickness (or density) which were obtained from a separate calculation. These were prepared by the National Space Science Data Center, covering the time period from 1981 to 1989, from space environment models AP-8, AE-5, AE-6, AEI-7, and SOLPRO. The radiation dose was calculated using an infinite slab shielding geometry for trapped electrons, bremsstrahlung, trapped protons, and solar protons. A plotting routine for graphing 26 shield thicknesses up to 700 mils of aluminum is provided. Instructions for program execution and data deck setup, samples of the data tables and graphs, and a program listing are included. GRA

N80-30359# RAND Corp., Santa Monica, Calif.
SATELLITE CONSTELLATIONS FOR WORLDWIDE AND HEMISPHERE COVERAGE Final Report
L. N. Rowell Dec. 1979 58 p refs 3 Vol.
(Contract DCA100-78-C-0058)
(AD-A086920; RAND/N-1432-DCA) Avail: NTIS HC A04/MF A01 CSCL 17/2
Continuous Earth-to-space communications require that at least one satellite be in view of the ground station at all times. The satellite constellations discussed in this note are designed to maximize the probability that one or more of the satellites in the constellation will always be at an elevation angle of 20 degrees or more above the horizon of the ground station. (This maximum elevation angle is based on the assumption that millimeter waves will be used for communication.) Constellations of satellites in circular orbits at synchronous and five times synchronous altitude and also in elliptical orbits are presented. Some of the constellations are designed to maximize global coverage and station located anywhere on Earth) and others are designed to maximize coverage for the northern hemisphere. GRA

N80-30360# Aerospace Corp., El Segundo, Calif.
CHARACTERISTICS OF ELECTRICAL DISCHARGES ON THE T78-2 SATELLITE (SCATHA) Progress Report,

12 Feb. - 24 Apr. 1979
Harry C. Koons 15 Jul. 1980 28 p refs
(Contract F04701-79-C-0080)
(AD-A087249; TR-0880(5505-02)-2; SD-TR-80-49) Avail: NTIS HC A03/MF A01 CSCL 22/1

The P78-2 (SCATHA) satellite was launched on 30 January 1979 to measure the characteristics of the spacecraft charging process near synchronous orbit. A Charging Electrical Effects Analyzer onboard measures the characteristics of electrical discharges in both the frequency and time domain. Pulses are detected in response to commands, during electron and ion beam operations and during natural charging events. GRA

N80-30361# Centre National d'Etudes Spatiales, Toulouse (France).
RITZ 2 SOFTWARE: DYNAMIC LONGITUDINAL ANALYSIS USING A VARIATIONAL METHOD FOR SLENDER BODIES OF REVOLUTION CONTAINING LIQUIDS [LOGICIEL RITZ 2 - ANALYSE DYNAMIQUE LONGITUDINALE PAR METHODE VARIATIONNELLE DE STRUCTURES MINCES DE REVOLUTION CONTENANT DES LIQUIDES]
Henri Morand (Direc. de Lanceurs) and Bruno Belon (CAP SOGETI) Sep. 1979 355 p In FRENCH; ENGLISH summary
(CNES-NT-91) Avail: NTIS HC A16/MF A01

A variational method to study launch vehicle structures by longitudinal modal analysis is presented along with the corresponding software. The method is especially well adapted to liquid propellant rocket behavior. The added mass of the liquid is calculated on the basis of a hydroelastic hypothesis and according to theoretically defined variation principles. A matrix representation is generated numerically using a finite element routine. Machine memory loading is minimized by a simultaneous assemblyreduction subroutine. The RITZ 2 software computes eigenvalues, eigenvectors, generalized masses, and dynamic pressures for most axisymmetric configurations. The results are shown appropriate for pogo studies. A program user manual is also included.
Author (ESA)

N80-30362# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
STUDY ON USE OF ISEE-B PLATFORM AS A PROBE FOR ESA/NASA COMETARY MISSION. VOLUME 1: TECHNICAL RESULTS Final Report
W. Trogus, R. D. Auer, R. Ockert, E. Bachor, L. Borucki, B. Caesar, R. Gieselmann, K. Goehler, M. Granzow, R. Hendricks et al Oct. 1979 291 p refs
(Contract ESTEC-3874/79-NL-MS)
(ESA-CR(P)-1316-Vol-1) Avail: NTIS HC A13/MF A01

The use of the existing international Sun Earth explorer B (ISEE-B) concept as probe for the planned cometary mission is assessed. A systems review covers mission and operations, selection and accommodation of a model payload as well as probe system configuration trade-offs. Starting from ISEE-B structure and subsystems, preferred solutions are selected and various options presented. Special points of effort were the definition of an micrometeorite hazard protection shield, the electromagnetic cleanliness, the confirmation of the thermal control design feasibility and the layout of spin-up ejection mechanism, which enclosed the antenna. It is concluded that the proposed probe baseline design and the subsystem concept are feasible and within state-of-the-art. Author (ESA)

N80-30363# European Space Agency, Paris (France).
SOUNDING ROCKET PROGRAM AERONOMY: COMPLEX PAYLOAD B2. REPORT OF SYSTEM DESIGN, INTEGRATION, TESTING AND FLIGHT
Hans Demharter, Guenter Hummeltenberg, Friedrich Kaczensky, and Hermann Waldmann Dec. 1979 128 p Transl. into ENGLISH of "Hoehenforschungsraketenprogramm aeronomie: Komplexe Nutzlast B2 Bericht ueber Systementwicklung, Integration, Test und Flug" Rept. BMFT-FB-W-77-34 Messerschmidt-Boelkow-Blohm G.M.B.H., Ottobrunn, West Germany, Dec. 1977 128 p Original report in GERMAN previously announced as N79-30277
(ESA-TT-589; BMFT-FB-W-77-34) Avail: NTIS HC A07/MF A01; ZLDI, Munich DM 96

The technical design and development of three payloads for sounding rockets to be flown onboard SKYLARK 3 are described. Test results obtained during qualification and flight acceptance tests with these payloads are shown and the performance of the payload systems is evaluated using the operations data recorded during flight by the ground station. Author (ESA)

N80-30364# Engins Matra, Velizy (France). Automatisms Dept. Study and Synthesis Div.
STUDY OF OTS 2: INFLIGHT BEHAVIOR NUTATION INTERACTION WITH MOMENTUM WHEEL Final Report
Jean-Louis Lacombe, Delaunay, G. Pelta, and A. Legars Dec. 1979 89 p refs
(Contract ESA-3768/78-NL-JS)
(Rept-30/1357; ESA-CR(P)-1328) Avail: NTIS HC A05/MF A01

Synthesis of OTS 2 inflight data characterizing the nutation indicates a constant linear damping of the nutation conical angle with the Teldix wheel in service. With the signal wheel in service there is a nutation angle divergence the time constant of which has daily periodic variation (+ or - 30%). angle variation were investigated including: passive energy dissipation due to liquid sloshing and to structural damping; energy dissipation inside the wheel bearings; coupling between nutation motion and pitch control; coupling between nutation and solar array drive system; and interaction with the external geomagnetic and solar disturbances. Comparison between OTS 2 and Symphonie behavior supports the conclusion that Teldix wheel bearings do not contribute significantly to nutation angle decay. Analysis of the grease bearing characteristics indicates that the observed behavior is consistent with a worst case effect of the grease bearing. Simple and safe in-flight tests are proposed to validate the study assumption. Author (ESA)

N80-30365# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France). Dept. d'Etudes et de Recherches en Technologie Spatiale.
BIRAMIS PAYLOAD STUDY. DETERMINATION OF THE RADIATION BALANCE OF THE EARTH WITH THE SPACE-BORNE MICROACCELEROMETER. VOLUME 2: CHARACTERIZATION AND SELECTION OF SPACECRAFT COATINGS Final Report [ETUDE DE LA DETERMINATION DU BILAN RADIATIF DE LA TERRE PAR MICROACCELEROMETRIE SPATIALE. ANNEXE 2: CARACTERISATION ET SELECTION DES REVETEMENTS]
Alain Paillous, Manola Romero, and Michel Riboulet May 1979 306 p refs In FRENCH; ENGLISH summary 3 Vol.
(Contract ESTEC-3454/77-NL-PP(SC))
(CERT-Vol-2: ESA-CR(P)-1334-Vol-2) Avail: NTIS HC A14/MF A01

Coatings for satellites were studied for a spacecraft which will measure the radiation budget of the Earth by detecting the radiation pressure through use of a microaccelerator (project BIRAMIS). Several types of coating were selected acting as radiation transducer and skin of the satellite. Their optical properties were identified in the solar and infrared range, and the thrust coefficient of the satellite was estimated.
Author (ESA)

N80-30366# Aerospace Engineering Office, Zurich (Switzerland).
STUDY OF A MATHEMATICAL MODEL OF A FLEXIBLE SOLAR ARRAY SUB-PANEL ASSEMBLY (VELSA 2) Final Report
K. J. Zimmermann 10 Dec. 1979 86 p refs
(Contract ESTEC-2990/76-NL-HP(SC))
(Rept-10.2-93/NT; ESA-CR(P)-1335) Avail: NTIS HC A05/MF A01

Methods and results of an analysis are presented for a flexible communication technology satellite (CTS) solar array sub-panel assembly and its correlation to test results. An approach is proposed for the design verification of large flexible solar arrays. The mathematical model used for the analysis of the blanket behavior is described and the methods applicable to the correlation of the mathematical model to the test results are discussed. The analytical results are given for the initial and the updated mathematical model for on-ground conditions. Dynamic results are provided for on-ground and on-orbit conditions differing from the later defined test conditions. Test enhancements are formulated based on the lack of data identified during the course of the model correlation. Aspects of the sensitivity of the mathematical

model to mesh size variations, boundary conditions, global and local stiffness changes, etc. were considered in the updated mathematical model. The latter predicts the test results with a sufficient accuracy (mean error 5%). Author (ESA)

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also 03 Air Transportation and Safety and 85 Urban Technology and Transportation.

N80-30367*# National Aeronautics and Space Administration, Washington, D. C.

THE SPACE SHUTTLE AT WORK

Howard Allaway 1979 83 p Original contains color illustrations

(NASA-SP-432; NASA-EP-156) Avail: NTIS HC $3.75/MF $3.75 CSCL 22B

The concept of the orbital flight of the space shuttle and the development of the space transportation system are addressed. How the system came to be, why it is designed the way it is, what is expected of it, and how it may grow are among the questions considered. Emphasis is placed on the effect of the space transportation system on U.S. space exploration in the next decade, including plans to make space an extension of life on the Earth's surface. J.M.S.

N80-30368*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

POGO SUMMARY REPORT MAIN PROPULSION TEST STATIC FIRINGS 1-7 FOR SHUTTLE DEVELOPMENT FLIGHT INSTRUMENTATION

C. M. Haddick, Jr. Jun. 1980 31 p refs

(Contract NAS9-15800)

(NASA-CR-160767; LEMSCO-15152; JSC-11613) Avail: NTIS HC A03/MF A01 CSCL 22B

Problems concerning the shuttle main propulsion system Polar Orbit Geophysical Observatory (POGO) instrumentation and the actions taken to correct them are summarized. Investigations and analyses appear to be providing solutions to correct the majority of questionable measurements. Corrective action in the handling of cables and connectors should increase the POGO measurement quality. Unacceptable levels of very low frequency noise and data level shifts may be related to test stand grounding configuration, but further investigation is required. L.F.M.

N80-30369*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex. Systems Engineering Dept.

STS-2 SAIL NON-AVIONICS SUBSYSTEMS MATH MODEL REQUIREMENTS

B. E. Carlton and R. W. Herold Jul. 1980 484 p

(Contract NAS9-15800)

(JSC-16748; LEMSCO-14524; NASA-CR-160772) Avail: NTIS HC A21/MF A01 CSCL 22B

Using a mathematical model, requirements for each of the nonavionic subsystems that interface with the shuttle avionics system are given. T.M.

N80-30370*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

STS-1 LOW-SPEED GROUND NAVIGATION CONSOLE PROCEDURES

Jon Weaver Aug. 1980 308 p

(NASA-TM-81134; JSC-16701; Rept-80-FM-35) Avail: NTIS HC A14/MF A01 CSCL 22A

The space Transportation System 1 Flight onorbit mission phase is broken into three distinct subphases; those subphases being the rev 1 through rev 6 contigency reentry opportunities, the general onorbit time period, and the rev 34 to the postdeorbit Guam pass inclusive. The necessary information to ensure that sufficient data tables are accummulated in real time to support the postmission off line ancillary data analysis studies designed to support postmission ancillary data generation and investigation of mission related anomalies is given. T.M.

N80-30371*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

MISSION PLANNING AND ANALYSIS DIVISION DEVELOPMENT PLAN FOR STS-2 THROUGH STS-4

Mar. 1980 158 p

(NASA-TM-81133; JSC-16520; Rept-80-FM-27) Avail: NTIS HC A09/MF A01 CSCL 22A

The baseline products, schedules, and resource requirements for the Mission Planning and Analysis Division's support of Space Transportation System flights 2, 3, and 4 are presented. Major functions addressed are: orbiter software, Mission Control Center software, flight design, flight operations support, simulation tools, and postflight analysis. L.F.M.

N80-30372*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

FLIGHT FEASIBILITY ASSESSMENT OF SHUTTLE/LANDSAT-D/LANDSAT-D' MISSIONS

Richard E. Kincade and Michael B. Wortham Aug. 1980 44 p ref

(NASA-TM-81145; JSC-16760; Rept-80-FM-38) Avail: NTIS HC A03/MF A01 CSCL 22A

Because of performance limitations, the shuttle cannot rendezvous with the LANDSAT D satellite in its primary orbit; the actual rendezvous altitude is a function of the performance of the two LANDSAT vehicles and of the shuttle. The feasibility of retrieving LANDSAT D from a 210 n.mi. orbit, following delivery of LANDSAT D' to a 200 n. mi. orbit was assessed from an orbital analysis point of view. Parameters such as orbital altitude, phasing and length of rendezvous, which affect flight design for this flight are identified. The results of a study made for delivery to a 235 n. mi. orbit followed by retrieval from 245 n. mi. are included. A.R.H.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation and 32 Communications.*

N80-30373*# Rensselaer Polytechnic Inst., Troy, N. Y. School of Engineering.

A HIGH SPEED TELEMETRY DATA LINK FOR AN AUTONOMOUS ROVING VEHICLE

David John Cipolle Aug. 1980 105 p refs Prepared for JPL

(Grant NsG-7369; Contract JPL-954880)

(NASA-CR-163495; RPI-TR-MP-72) Avail: NTIS HC A06/MF A01 CSCL 09F

A data link system used on a prototype autonomous roving vehicle is described. This system provides a means of acquiring, formatting, and transmitting information on board the vehicle to a controlling computer. Included is a statement of requirements and the design philosophy. Additionally, interfacing with the rover systems is discussed, along with the overall performance of the telemetry link. Author

N80-30374# Ballistic Research Labs., Aberdeen Proving Ground, Md.

SIMULANT REACTION TEMPERATURE MEASUREMENT VIA TELEMETRY FOR THE XM736 AT CHARGE 9 Final Report

William P. Damico, Jr. May 1980 61 p refs Supersedes ARBRL-IMP-639

(DA Proj. 1W4-64610-DF-94)

(AD-A086774; AD-E430472; ARBRL-MR-03021; ARBRL-IMP-639) Avail: NTIS HC A04/MF A01 CSCL 19/1

Six XM736 projectiles were fitted with a payload temperature measurement/telemetry system and fired at Charge 9 with flight times of approximately 100 seconds. Temperatures of the reaction produced by the liquid simulants were as high as 350 C during the terminal portions of the trajectory. These high temperatures

may be related to recent base failures that occurred during safety tests. GRA

N80-30375# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
TELEMETRY SYSTEM FOR EVALUATION OF BURN PROTECTION IN FULL-SCALE FUEL FIRE MANIKIN EXPOSURES Final Report
J. R. Piergallini and A. M. Stoll 1 May 1980 12 p refs (ZF61542001)
(AD-A086700; NADC-80092-60) Avail: NTIS HC A02/MF A01 CSCL 09/6

An eighteen channel PAM/FM (Pulse Amplitude Modulated/Frequency Modulated) telemetry system was developed for measuring temperature rise on the surface of a manikin beneath protective clothing for full-scale fuel fire exposures in completely enveloping flames. Thermistors are used as temperature sensors at various locations on a manikin surface and backed by material of known thermal properties in order to correlate temperature rise with skin burn damage. The transmitted signals are recorded on analog magnetic tape and converted to a digital format for computer analysis. The clothed manikin is passed through an aviation gasoline fire for three seconds with the telemetry system recording data during this period. Temperatures are analyzed at 0, 1, 2 and 3-second intervals with voltage outputs from the thermistors being converted to resistance readings and temperature readings by equations developed from curves of thermistor characteristics. Experimental results with respect to burn prediction are in agreement with data obtained by analysis of vesicant papers calibrated radiometrically to correlate with temperature-time effects productive of burns in living tissue. To date, 12 full-scale fuel fire tests have been conducted using the telemetry system and the performance of this system has exceeded original expectations in many respects such as sensitivity, accuracy and freedom from interference by ionizing gases within the flames. GRA

N80-30320*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ACCURATE RADIO POSITIONS WITH THE TIDBINBILLA INTERFEROMETER
M. J. Batty (CSIRO, Sydney), D. J. Jauncey (CSIRO, Sydney), P. T. Rayner (CSIRO, Sydney), and S. Gulkis *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 1-5 refs (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 17G

N80-30323*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VLBI SYSTEM FOR WEEKLY MEASUREMENT OF UT1 AND POLAR MOTION: PRELIMINARY RESULTS
M. Roth and T. Yunck *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 15-20 refs (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 17G

N80-30324*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PROGRESS REPORT ON THE BLOCK 1 VLBI CORRELATOR IMPLEMENTATION
J. C. Peterson, J. W. Dillon, and D. H. Rogstad *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 21-23 (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 17G

N80-30325*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
BLOCK 1, PHASE 1 VERY LONG BASELINE INTERFEROMETRY IMPLEMENTATION
J. H. Wilcher *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 24-27 ref (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 17G

N80-30332*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
INPUT SIGNAL CONDITIONER FOR THE MULTIMEGASYMBOL TELEMETRY SYSTEM FEASIBILITY MODEL
G. L. Stevens *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 49-58 ref (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 17B

N80-30338*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
NAVIGATION NETWORK OPERATIONAL CONSIDERATIONS
E. Hird *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 97-107 refs (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 17G

N80-30339*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
GROUND COMMUNICATION FACILITY AND NETWORK OPERATIONS CONTROL CENTER RECONFIGURATION
D. S. Bremner and C.-K. Hung *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 108-109 ref (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 17B

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-30376 Virginia Polytechnic Inst. and State Univ., Blacksburg.
DYNAMICS AND CONTROL IN MODAL-SPACE OF FLEXIBLE SPACECRAFT Ph.D. Thesis
Hayrani Oz 1979 191 p
Avail: Univ. Microfilms Order No. 8020190

The independent modal space control proposed in this investigation shifts the problem of high dimensionality from the control problem to the structural dynamics problem, in recognition of the fact that the capabilities of available structural dynamics computational algorithms exceed those of modern control theory by at least one order of magnitude. The controller design is modular in form. Both nongyroscopic and gyroscopic systems are being considered. It is shown that for nongyroscopic systems no control spillover exists due to the uncontrolled modes included in the mathematical model. In the case of gyroscopic systems, the method calls for a 2nth order mathematical model to control n modes independently, which results in the elimination of the truncation effects relative to the 2nth order model in controlling the n modes. The derivation of a deterministic decoupled modal observer which estimates a linear combination of the modal state is given. Dissert. Abstr.

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N80-30377*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CALIBRATION VALIDATION FOR THE GEOS-3 ALTIMETER
C. F. Martin (Edgerton, Germeshausen and Grier, Inc., Riverdale, Md.) and R. Kolenkiewicz Jun. 1980 43 p refs Submitted for publication
(NASA-TM-80710) Avail: NTIS HC A03/MF A01 CSCL 14B

The absolute bias calibration for the GEOS-3 intensive mode altimeter was measured using two satellite passes whose

groundtracks were within 1 km of the Bermuda laser station. The Bermuda laser tracked on the two passes, and was supported by two other NASA lasers on one pass and by the NASA Spacecraft Tracking and Data Network on the other pass. For each pass, the altimeter data around Bermuda was smoothed and extrapolated to the point closest to overhead at the laser site. After correcting for tide heights and sea state effects, the two passes give calibration biases which are in agreement to within 26 cm and have a weighted mean of -5.69 + or - 0.16m for correcting altimeter measurements to the center-of-mass of the spacecraft (i.e., including the antenna tracking point correction). It was found impossible to reconcile the two calibration passes, as well as a set of altimeter crossovers in the middle of the GEOS-3 calibration area, without allowing for a data time tag error. On the bias of a selected set of four crossovers, and an assessment of probable sources of timing error, it was concluded that one interpulse period (10.24 msec) should be added to the data time tags. L.F.M.

N80-30378# Osservatorio Astronomico, Trieste (Italy). Gruppo Strumentazione ed Elaborazione Dati.
SUB ARC SECOND SENSOR CALIBRATION Final Report
G. Sedmark, S. Furlani, M. Pucillo, L. Rusconi, and P. Santin 3 Nov. 1978 155 p refs
(Contract ESTEC-3413/77-NL-AK(SC))
(OAT-586; ESA-CR(P)-1309) Avail: NTIS HC A08/MF A01

A feasibility study was performed for a subarcsecond sensor calibration system capable of performing geometrical calibrations on star and Sun sensors of accuracy of 1 milliarcsecond over + or - 1 arcsecond and 10 milliarcseconds over + or - 1 arcdegree, respectively. The realization of a calibration system consistent to the specified accuracy is meaningful only if the sensors to be calibrated are substantially insensitive to a rotationally symmetrical curvature of the wavefront output from the calibration system. The monitor subsystems required can be implemented by means of commercially available laser interferometers and autocollinators. The actuators required for positioning of the system components can be implemented by integrating commercially available piezoelectric actuators to custom-made electric motor endless screw actuators. The system should be isolated to external mechanical noise by a stack of two antivibration tables. Moreover, it is necessary to operate the system in a vacuum of 0.00001 atmosphere to avoid beam propagation errors induced by the atmosphere. The system should be computer controlled to optimize the calibration operations against internal mechanical noise, while the typical sensor scanning speed should not exceed 10 scans/second.
Author (ESA)

N80-30379# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Direction des Etudes de Synthese.
BIRAMIS PAYLOAD STUDY, VOLUME 1
A. M. Mainguy 29 Jun. 1979 137 p refs 3 Vol.
(Contract ESTEC-3454/77)
(ONERA-RT-4/3373-SYP-Vol-1; ESA-CR(P)-1334-Vol-1) Avail: NTIS HC A07/MF A01

The results obtained during the study of a spaceborne microaccelerometer are reported. The various coatings as well as the simulation are described in detail. Methods for calibrating this system on the ground and in orbit are discussed. R.C.T.

N80-30380# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Direction de la Physique Generale.
BIRAMIS PAYLOAD STUDY. VOLUME 3: THE ACCELEROMETER SUPER-CACTUS [BIRAMIS - ETUDE DE LA CHARGE UTILE. 3: AVANT-PROJET DE L'ACCELEROMETRE SUPER-CACTUS]
A. Bernard, M. Gay, R. Juillerat, and M. LeFevre (Societe d'Applications Generales d'Electricite et de Mecanique) 25 Jun. 1979 163 p refs In FRENCH; ENGLISH summary 3 Vol.
(Contract ESA-3454/77)
(ONERA-RT-5/3373-SY-Vol-3; ESA-CR(P)-1334-Vol-3) Avail: NTIS HC A08/MF A01

A preliminary design study was performed for a three axis electrostatic microaccelerometer (Super CACTUS), having a measuring range of 10 to the minus 10th power m/sec. The instrument will be carried in the center of a spherical satellite measuring the Earth's radiation budget through detection of the radiation pressure (Project BIRAMIS). A capacitative microbalance was adapted to study the physical phenomena of the ball-cage contact. Experiments with this device are reported, along with theoretical studies supporting modifications to the original CACTUS device flown on the CASTOR experiment.Author (ESA)

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N80-30381 Applied Physics Lab., Johns Hopkins Univ., Laurel, Md. Chemical Propulsion Information Agency.
THE 1980 JANNAF PROPULSION MEETING, VOLUME 5
Karen L. Strange, ed. Mar. 1980 645 p refs Meeting held in Monterey, Calif., 11-13 Mar. 1980 7 Vol.
(Contract N00024-78-C-5384)
(AD-A087063; CPIA-Publ-315-Vol-5) Avail: Issuing Activity CSCL 21/8

Liquid, solid, air breathing, and electric propulsion technology is presented in terms of tactical, strategic, and space applications. Specific emphasis is placed on propulsion technology for the space transportation system vehicles as well as communication satellites and missiles. For individual titles, see N80-30382 through N80-30421.

N80-30382* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYTICAL INVESTIGATION OF TWO HYDROGEN-OXYGEN ROCKET ENGINE SYSTEMS FOR LOW-THRUST APPLICATION
Dean D. Scheer *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 1-20 refs (For primary document see N80-30381 21-20)
Avail: Issuing Activity CSCL 21H

Two hydrogen-oxygen rocket engine system concepts were analyzed parametrically over a thrust range from 100 to 1000 pounds and a chamber pressure range from 175 to 1000 psia. Both concepts were regeneratively cooled with hydrogen and were pump fed by electric motor driven positive displacement pumps. Electric power was provided by either a turboalternator (turboalternator concept) or some means external to the engine system (auxiliary power concept). The computer program used to conduct the analyses along with the design characteristics of the major engine system components are briefly described. The feasible design range of the systems over the parametric range of thrust is discussed in terms of allowable chamber pressure considering the constraints of thrust chamber cooling and cycle power. Engine system estimated performance, mass, and dimensional envelope parametric data within the feasible design range are presented. Author

N80-30383* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LeRC REDUCED GRAVITY FLUID MANAGEMENT TECHNOLOGY PROGRAM
J. C. Aydelott and E. P. Symons *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 21-34 refs (For primary document see N80-30381 21-20)
Avail: Issuing Activity CSCL 21H

An overview of studies addressing reduced gravity fluid management problems using scale model propellant tanks in drop towers that provided up to five seconds of reduced gravity test time is given. The Cryogen Fluid Management Experiment designed to provide an orbital evaluation of a subcritical liquid hydrogen storage and supply as part of the shuttle/Spacelab program is described. An experiment to study orbital transfer of liquids and a Spacelab facility capable of housing multiple fluid dynamic and heat transfer experiments are also discussed.

Progress in the analytical evaluation of propellant management systems for both low and high thrust orbit transfer propulsion systems and the development of computer techniques for simulating reduced gravity fluid dynamic processes is reported.
J.M.S.

N80-30384* Rocketdyne, Canoga Park, Calif.
LEO-TO-GEO LOW THRUST CHEMICAL PROPULSION
J. M. Shoji *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 35-51 refs (For primary document see N80-30381 21-20)
(Contract NAS3-21941)
Avail: Issuing Activity CSCL 21H

One approach being considered for transporting large space structures from low Earth orbit (LEO) to geosynchronous equatorial orbit (GEO) is the use of low thrust chemical propulsion systems. A variety of chemical rocket engine cycles evaluated for this application for oxygen/hydrogen and oxygen/hydrocarbon propellants (oxygen/methane and oxygen/RF-1) are discussed. These cycles include conventional propellant turbine drives, turboalternator/electric motor pump drive, and fuel cell/electric motor pump drive as well as pressure fed engines. Thrust chamber cooling analysis results are presented for regenerative/radiation and film/radiation cooling.
J.M.S.

N80-30385 Aerojet Liquid Rocket Co., Sacramento, Calif. Orbit Transfer Vehicle Propulsion Systems.
ADVANCED EXPANDER CYCLE ENGINE FOR MANNED ORBIT TRANSFER VEHICLES
L. B. Bassham *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 53-67 refs (For primary document see N80-30381 21-20)
Avail: Issuing Activity CSCL 21/8

An approach to the design of a high energy orbit transfer vehicle (OTV) space engine using an advanced expander turbopump power drive cycle (AEC) is presented. The AEC engine concept selection resulted from an evaluation of potential performance, and risk reduction considerations. As such, the AEC engine meets all mission technical requirements of low weight, and high performance with a fixed envelope with maximum service life (totally reuseable) while maintaining benign operating environment for all critical components. Engine power cycle alternatives are evaluated against the design drivers and trades are made which isolate the most desirable features. Development risk is then factored into the evaluation to definitize the most desirable solution. The selected advanced expander engine (AEC) exemplifies the mergence of previous operational experience, manned system requirements and performance of high energy propellants with economic risk assessment for the manned orbit transfer vehicle engine.
J.M.S.

N80-30386* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
UPPER STAGES UTILIZING ELECTRIC PROPULSION
David C. Byers *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 69-84 refs (For primary document see N80-30381 21-20)
Avail: Issuing Activity CSCL 21H

The payload capabilities of upper stages using electric propulsion for a LEO to GEO orbit transfer mission are presented. The impact on payloads of total mass in LEO, thrusting (trip) time, propellant type, specific impulse, and power source characteristics was evaluated. Dependent upon detailed assumptions, electric stages were found capable of delivering payloads in thrusting time less than 50 days with payloads always initially increasing rapidly with increasing thrusting times. For the shorter thrusting (trip) times the payloads increased with increasing propellant mass and decreasing specific impulse. At very long trip times, however, the payload increased with decreasing propellant mass and increasing specific impulse. Variation of the specific mass of the power source between 5 and 30 kg/kW caused the minimum trip times to vary about a factor of three and at short trip times strongly affected the electric stage payload capabilities.
J.M.S.

N80-30387 Rocketdyne, Canoga Park, Calif.
CRYOGENIC LOX/H2 ENGINE CANDIDATES FOR ORBITAL TRANSFER MISSIONS. PART 1: EXPANDER CYCLE OPTIMIZATION
R. Wahl, A. Martinez, A. Sobin, and J. Glass *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 85-100 (For primary document see N80-30381 21-20)
Avail: Issuing Activity CSCL 21H

Main propulsion LOX/hydrogen engines exhibiting high performance, high reliability, reusability, light weight, simplicity, and well advanced state of development were characterized for use in the orbital transfer vehicle (OTV). Two well known engine cycles (the staged combustion and the expander) demonstrated the best potential of meeting OTV requirements, with the staged combustion excelling in performance and the expander excelling in mechanical simplicity. Characterization included performance, weight, payload, cost, programmatics, engine off design operation, reliability, and risk assessment analyses. Results provided inputs for subsequent vehicle studies and indicated further optimization of both engines was in order. In the case of the expander cycle engine, further optimization has increased performance significantly, while in the case of the staged combustion cycle engine simplicity and performance are improved.
J.M.S.

N80-30388* Aerojet Liquid Rocket Co., Sacramento, Calif.
DUAL THROAT ENGINE DESIGN FOR A SSTO LAUNCH VEHICLE
C. J. OBrien and J. W. Salmon *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 101-118 refs (For primary document see N80-30381 21-20)
(Contract NAS8-32967)
Avail: Issuing Activity CSCL 21H

A propulsion system analysis of a dual fuel, dual throat engine for launch vehicle application was conducted. Basic dual throat engine characterization data are presented to allow vehicle optimization studies to be conducted. A preliminary baseline engine system was defined. Dual throat engine performance, envelope, and weight parametric data were generated over the parametric range of thrust from 890 to 8896 KN (200K to 2M lb-force), chamber pressure from 6.89 million to 34.5 million N/sq m (1000 to 5000 psia) thrust ratio from 1.2 to 5, and a range of mixture ratios for the two tripropellant combinations: LO2/RP-1 + LH2 and LO2/LCH4 + LH2. The results of the study indicate that the dual fuel dual throat engine is a viable single stage to orbit candidate.
Author

N80-30389* Thiokol Corp., Brigham City, Utah. Wasatch Div.
SPACE SHUTTLE SOLID ROCKET MOTOR (SRM) DEVELOPMENT AND QUALIFICATION
Robert K. Lund and Boyd C. Brinton *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 119-134 (For primary document see N80-30381 21-20)
(Contract NAS8-30490)
Avail: Issuing Activity CSCL 21H

The configuration of reusable solid propellant motors for the space shuttle vehicle is delineated and traces their design evolution. Also presented are the summary results of the first two of the three qualification motor firings designated QM-1 and QM-2.
J.M.S.

N80-30390 Aerojet Liquid Rocket Co., Sacramento, Calif.
TITAN LIQUID BOOST MODULE FOR SHUTTLE PERFORMANCE AUGMENTATION
J. G. Muehlbauer and A. E. Inman (Martin Marietta Corp., Denver, Colo.) *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 135-145 (For primary document see N80-30381 21-20)
Avail: Issuing Activity CSCL 21/8

The shuttle orbital vehicle 103/external tank 26 has a projected payload capability of 24,000 pounds on DOD Mission 4 with a 109% rated thrust level SSME, a 6,000 lb external tank weight reduction, and a 5,100 lb orbiter weight reduction. As this is significantly below the 32,000 lb Mission 4 requirement, performance enhancement, in the form of thrust augmentation is supplied by the Titan Liquid Boost Module (LBM). The Titan LBM, installed aft of the external tank, has ignition at five seconds after liftoff when the shuttle is clear of the facility. Following a 200 second burn, LBM is jettisoned using an ordnance separation device. This burn duration provides over 17,000 pounds

performance improvement at VAFB, well beyond Mission 4 requirements. J.M.S.

N80-30391* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
FLUORINE-HYDRAZINE PROPULSION TECHNOLOGY UPDATE
D. L. Bond, M. A. Appel, and G. W. Kruger *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 147-164 refs (For primary document see N80-30381 21-20)
(Contract NAS7-100)
Avail: Issuing Activity CSCL 21H

The current status of the fluorine hydrazine propulsion system development is discussed. Progress on the components, rocket engine, and system design is presented. A detailed look at a fluorine hydrazine system as a potential propulsion option for the Galileo Project (Jupiter orbiter) is delineated and the results of safety and technical reviews which were accomplished to verify the feasibility of this option are summarized. J.M.S.

N80-30392* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A PUMP FED BIPROPELLANT PROPULSION SYSTEM FOR PLANETARY MISSIONS
P. N. Estey *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 165-179 refs (For primary document see N80-30381 21-20)
(Contract NAS7-100)
Avail: Issuing Activity CSCL 21H

A pump fed bipropellant liquid propulsion system is proposed for use on planetary missions. The primary use of this system is to provide the thrust for orbit insertion around the planet. The mass scaling equations for the pump fed and pressure fed N2O4/MMH propulsion systems are developed and presented graphically. It is shown that the pump fed propulsion system begins to be less massive than the equivalent pressure fed system at a propellant mass of approximately 450 kg (1000 lb sub m). Using the Venus Orbiting Imaging Radar (VOIR) mission as an example, it is shown that the pump fed propulsion system saves approximately 371 kg (818 lb sub m) of spacecraft mass at launch over the VOIR spacecraft using a pressurized propellant feed system. Some of the candidate pumps and drive systems are presented and briefly described. The applicability of the pump fed system to the JPL fluorine hydrazine propulsion system is also addressed. J.M.S.

N80-30393* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
HEAT STERILIZABLE PROPELLANT DEVELOPMENT
F. A. Anderson, S. H. Kalfayan, and C. A. Wilkins *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 181-201 refs (For primary document see N80-30381 21-20)
(Contract NAS7-100)
Avail: Issuing Activity CSCL 21H

The development of solid propellants which are stable at temperatures up to 135 C for periods of time sufficiently long to allow the propellant to be thermally sterilized is considered. Ingredient modifications and processing methods developed enabling the processing of 32 kg (70 lbs) propellant grains that have successfully withstood seventeen cycles of fifty-four (54) hours each at 135 C are discussed. J.M.S.

N80-30394 TRW Defense and Space Systems Group, Redondo Beach, Calif. Subsystem Engineering Section.
UNDERSTANDING FLOW BLOCKAGE IN SMALL THRUSTERS
D. E. Fritz, R. L. Sackheim, and J. C. Lewis *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 203-216 refs (For primary document see N80-30381 21-20)
Avail: Issuing Activity CSCL 21/8

The requirements of high performance, low thrust, and large total impulse of hydrazine engines used in geosynchronous communication satellites are discussed. The use of electrical augmentation energy to increase thruster specific impulse into the 300 second range is considered. The phenomenon of nonvolatile residue (NVR) deposition in the small diameter injector flow passageways of low thrust hydrazine engines is investigated. The deposition rate affects the life and performance of both conventional catalytic and electrical augmented thrusters. Data of nonvolatile residue induced flow blockage in hydrazine engines are presented. Mechanisms for NVR deposition and design considerations for minimizing or eliminating NVR buildup are discussed. J.M.S.

N80-30395 Communications Satellite Corp., Clarksburg, Md.
NORTH-SOUTH STATION KEEPING WITH ELECTRIC PROPULSION USING ONBOARD BATTERY POWER
B. A. Free *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 217-229 refs Sponsored by the International Telecommunications Satellite Organization (For primary document see N80-30381 21-20)
Avail: Issuing Activity CSCL 21/8

If electric propulsion is substituted for monopropellant hydrazine for north-south stationkeeping of geostationary satellites, a net propulsion system mass reduction equal to about one tenth of spacecraft mass is gained. Conventional solar cell powering of the electric propulsion system imposes a severe cyclic lifetime requirement. With onboard batteries, larger and more efficient thrusters can be used, and the required cyclic lifetime is reduced considerably. Battery powered electric propulsion becomes more feasible as the satellite end of life power-to-mass ratio increases, and as the thruster efficiency improves. Battery powered north-south stationkeeping (NSSK) is practicable for many satellites with state of the art electric propulsion hardware. Author

N80-30396 Air Force Rocket Propulsion Lab., Edwards AFB, Calif.
US AIR FORCE PROGRAMS IN ELECTRIC PROPULSION
R. J. Vondra *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 231-243 refs (For primary document see N80-30381 21-20)
Avail: Issuing Activity CSCL 21H

Development of the milliNewton solid Teflon pulsed plasma thruster (PPT) for auxiliary propulsion use is discussed. Exploratory efforts to evaluate the magnetoplasmadynamic (MPD) thruster, the pulsed inductive thruster and rail gun technology for primary propulsion application are described. J.M.S.

N80-30397 TRW Defense and Space Systems Group, Redondo Beach, Calif.
FRACTURE MECHANICS DESIGN OF SHUTTLE PAYLOAD PRESSURE VESSELS
J. C. Lewis *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 245-268 refs (For primary document see N80-30381 21-20)
Avail: Issuing Activity CSCL 21/8

Shuttle payload safety policy permits fracture mechanics design of payload pressure vessels to save weight. The behavior of pre-existing cracks in thin walled metallic pressure vessels is described. A logical approach to fracture mechanics design of thin-walled pressure vessels is presented. Step-by-step procedures for determining initial crack sizes and crack propagation rates are given. Techniques for generating required fracture mechanics design data are described. Finally, an analytical example for determining the wall thickness from fracture mechanics properties is shown. J.M.S.

N80-30398 Air Force Rocket Propulsion Lab., Edwards AFB, Calif.
PULSED PLASMA PROPULSION TECHNOLOGY
V. N. Benham and M. R. Brasher *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 269-280 (For primary document see N80-30381 21-20)
Avail: Issuing Activity CSCL 21/8

A pulsed plasma propulsion system with an impulse bit approximately 50 times larger and total impulse approximately 25 times larger than previous is described. The helical feed thruster system consisting of electrodes, capacitors, electronics, and propellant is integrated into a high altitude facility and operated 24 hours a day. Direct impulse and mass discharge measurements are taken to determine the performance of the thruster. Analysis is made during testing of any deficiencies in thruster system design which affect the long life and high performance. The discharge life testing of low inductance, extended foil capacitors having a design life of 10 to the 7th power shots and an energy

density of 88J/kg when operated at rated voltage and peak currents of 35KA, reversal of 25%, and rep-rate below Hz is discussed. The earlier capacitors consist of aluminum foil and a dielectric sandwich of polyvinylidene fluoride film ('K-film'), paper, and castor oil impregnant. They have a nominal capacity of 65 mu fd and are rated 2.5KV. The newer capacitors are composed principally of aluminum foil, 'K-film' and silicon oil impregnant. These have a nominal capacity of 80 mu fd and are rated at 2.2KV. J.M.S.

N80-30399* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
OXYGEN PRODUCTION FOR INTERPLANETARY RETURN MISSIONS
R. Richter, R. Ash (Old Dominion Univ., Norfolk, Va.), and W. Dowler *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 281-299 refs (For primary document see N80-30381 21-20)
(Contract NAS7-100)
Avail: Issuing Activity CSCL 21H

Interplanetary missions with extraterrestrial returns are limited by large propulsion mass requirements. The injected mass landed on an extraterrestrial body can be reduced substantially by utilizing indigenous materials for the production of propellant on the extraterrestrial body. Analyses reported show that for Mars return missions, in situ production of oxygen during the wait between landing and the next low-energy return opportunity reduces the Earth-launch mass requirements to the allowable limit for direct entry and direct return missions. A small chemical processor using radioisotope thermal energy can extract oxygen several times its own mass from carbon dioxide, during the several-hundred-days wait on Mars. The fundamental element of the concept is the electrolytic process. Solid electrolyte cells for extracting oxygen from gaseous feedstock are identified. The basic physical principles underlying the extraction process are analyzed, and the relations between the major parameters established. The laboratory equipment for experimental investigation of the process is presented. J.M.S.

N80-30400 Hughes Aircraft Co., El Segundo, Calif. Space and Communications Group.
PROPULSION SUBSYSTEM FOR THE SATELLITE DATA SYSTEMS SATELLITE
J. K. Anthony (Air Force Space Div., El Segundo, Calif.) and W. W. Butcher *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 301-315 (For primary document see N80-30381 21-20)
(Contract F04701-79-C-0006)
Avail: Issuing Activity CSCL 21/8

An integral satellite propulsion subsystem designed to perform orbit transfer as well as on orbit attitude control is described. The considerations and decisions made in configuring and designing the propulsion subsystem for a spinning STS specialized spacecraft are outlined. The development of a new propulsion subsystem application is reported including the propellant tanks, solid motor, and bipropellant thrusters. The propulsion subsystem operation is discussed as it relates to the mission sequence following ejection from the shuttle cargo bay. The paper is concluded with a brief discussion of propulsion subsystem testing with emphasis on unique tests. J.M.S.

N80-30401 Ford Aerospace and Communications Corp., Palo Alto, Calif.
BIPROPELLANT PROPULSION SYSTEM FOR INSAT-1
V. A. Moseley and R. C. Stechman (Marquardt Corp., Van Nuys, Calif.) *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 317-324 (For primary document see N80-30381 21-20)
Avail: Issuing Activity CSCL 21/8

The requirements, system design and component characteristics of the propulsion system for the INSAT-1 communications/meteorological satellite are presented. This three axis stablized satellite is the first to employ an integrated bipropellant N2O4 - MMH system to provide all propulsion maneuvers after transfer orbit injection for a geosynchronous satellite. A total impulse capability of 400,000 lb-sec with growth capability without hardware change up to 444,000 lb-sec is provided in this 132 lb dry weight system, which includes one 100 lb apogee thruster and twelve 5 lbf attitude and orbit control thrusters fed by two 33 in diameter titanium propellant tanks. Author

N80-30402 United Technologies Corp., Sunnyvale, Calif. Chemical Systems Div.
IUS MOTOR CASE DEVELOPMENT
Hugh M. Reynolds *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 325-353 (For primary document see N80-30381 21-20)
(Contract F04701-78-C-0040)
Avail: Issuing Activity CSCL 21/8

The development of the 63- and 93- inch diameter Kelvar/epoxy filament wound rocket motor cases for the inertial upper stage (IUS) propulsion system is decribed. The (IUS) requirements for the motor case are discussed in terms of its performance beyond the state of the art for large composite motor cases. Particular emphasis is placed on the skirt structural load requirements for the SRM-1. R.C.T.

N80-30403 Thiokol Corp., Brigham City, Utah. Wasatch Div.
QUALIFICATION OF MINUTEMAN STAGE 3 MOTOR FOR SPIN STABILIZED PERIGEE STAGES
Evan E. Day *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 355-374 refs (For primary document see N80-30381 21-20)
Avail: Issuing Activity CSCL 21/8

The third stage of the Minuteman III ICBM was modified for space transportation system launch as a tailored upper stage. In order to use the Minuteman unique combination of performance (2.1 million lbf-sec), reliability (100% on 140 tests), and maturity (900 built), the motor was static fired while spinning at 70 rpm and 100 F, and also at 40 rpm and 40 F after three full temperature cycles. The propellant was also tested for spin effects up to 27 g in small motors, and the ignition system, propellant and case materials subjected to long vacuum exposure. All of the conditions of carry and launch from the shuttle were extensions of previous qualification on expendable missile vehicles. R.C.T.

N80-30404 Norton AFB Ballistic Missile Office, Calif.
MISSILE-X OVERVIEW
James A. DiBiase *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 375-386 (For primary document see N80-30381 21-20)
Avail: Issuing Activity CSCL 21/8

An overview of the Missile-X (MX) weapon system is presented. The missile as well as the main features of its operation are summarized. The technologies being used in the development of the MX missile are described, an assessment of their risk is presented, and a comparison is made with the Minuteman III missile. A brief description is given of the proposed basing concept as well as its planned mode of operation are also given. R.C.T.

N80-30405 Thiokol Corp., Brigham City, Utah. Wasatch Div.
MX STAGE 1
Jack G. Hilden and P. R. Dykstra *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 387-396 (For primary document see N80-30381 21-20)
(Contract F04704-78-C-0009)
Avail: Issuing Activity CSCL 21/8

The full scale development of the MX missile is described. The operation modes of the stage one program are addressed with emphasis on the following: the functional requirements of the stage; the first stage performance requirements; and the program structure. R.C.T.

N80-30406 Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.
COMMAND CONTROL OF SOLID PROPELLANT GAS GENERATORS AND THRUSTERS BY HOT CUTTERS
Leonard H. Caveny *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 397-411 refs (For primary document see N80-30381 21-20)
Avail: Issuing Activity CSCL 21/8

A propulsion concept which is based on a simple thermomechanical means of increasing the rate at which the propellant burning surface regresses. The rocket motor firings which demonstrate the feasibility of the concept are described. It is shown that thrust and mass generation rate modulation ratios

in excess of 20:1 are possible. Motor firings demonstrated the fail-safe properties of the concept. The concept is not limited by the burning rate pressure exponent or by difficulties in burning metallized/fuel-rich propellants. applications to thrusted and masking decoys are described. R.C.T.

N80-30407 Auburn Univ., Ala. Dept. of Chemistry.
SYNTHESIS OF CMP BEGINNING WITH SODIUM BOROHYDRIDE c28
F. A. Johnson and W. E. Hill *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 413-422 (For primary document see N80-30381 21-20)
(Contract DASG60-78-C-1043)
Avail: Issuing Activity CSCL 21/8

The chemical synthesis of carborane was accomplished via three major steps: (1) pyrolysis of BH4(-) to B10H10(-2); (2) cage opening of B10H10(-2) to B10H12L2 (Lewis base); and (3) conversion of B10H12L2 to carborane. A differential scanning calorimeter was used to study the pyrolysis of Et4NBH4. The results are consistent with preparation of BH10H10(-2) ion in high yield. Efforts to ameliorate the erratic nature of the B10H10(-2) synthesis were patialy successful. Yields of 50% were consistently obtained at one atmosphere in conventional glass apparatus. R.C.T.

N80-30408 Callery Chemical Co., Pa.
PYROLYSIS OF (C2H5)4NBH4 TO [(C2H5) 4N] 2B10H10: USE OF A LIQUID HEAT TRANSFER MEDIUM c28
J. L. Little and R. M. Hunt *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 423-433 refs (For primary document see N80-30381 21-20)
(Contract DASG60-78-C-0146)
Avail: Issuing Activity CSCL 21/8

Scaleup of the pyrolysis of tetraethylammonium borohydride (Et4NBH4) to (bis)-tetraethylammonium dodecahydrododecaborate ([Et4N]2B10H10) was accomplished using triethlamine borane (TEAB) or mineral oil to obtain a stirrable slurry as an aid to heat transfer. The optimum ratio of Et4NBH4 to TEAB was 1.5 to 1. Reactor modification which facilitates removal of triethylamine lead to higher overall product yields and a higher percentage yield of B10H10(-2). Substituting mineral oil for TEAB gave lowered yield to B10H10(-2) further verifying that TEAB participates in the pyrolysis reaction. R.C.T.

N80-30409 Thiokol Corp., Huntsville, Ala.
REDUCTION IN COST OF ROCKET MOTOR MANUFACTURE BY USE OF LINER WITH CONTROLLABLE CURE
R. T. Davis, J. D. Byrd, I. G. Shepard, and K. E. Bevel *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 435-465 (For primary document see N80-30381 21-20)
Avail: Issuing Activity CSCL 21/8

A method was developed that reduces the processing costs of solid propellant rocket motors. This method employed the blocked isocyanate principle to produce a liner with a controllable cure which provides for either a short or long pot life and hold time capability. Cost reduction was achieved by flexibility in scheduling and utilization of equipment and facilities. A liner pot life in excess of 400 hours at 25 C (77 F) was demonstrated; at lower temperatures, a pot life in excess of 12 weeks was obtained. R.C.T.

N80-30410 Aerojet Liquid Rocket Co., Sacramento, Calif.
SINGLE STAGE LIQUID PROPULSION SYSTEMS: SPECIFIC OPTIMA FOR NRBM VEHICLES
D. W. Culver *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 467-480 (For primary document see N80-30381 21-20)
Avail: Issuing Activity CSCL 21/8

Storable bipropellant liquid rocket propulsion systems were evaluated for Medium Range Ballistics Missiles Vehicle application. Propulsion subsystem scoping studies, system conceptual designs, system mathematical modeling, and computer aided parametric system evaluation were included. Subsystem concept selections included propellants, propellant feed system, tankage geometry, propellant control, tank pressurization, pump fed engine cycle, thrust chamber assembly geometry, and thrust chamber assembly cooling. Results indicate the single stage selected design to be lighter weight than a two stage solid or liquid pressure fed system for equal range and payload requirements and to provide lower missile system life cycle cost than a two stage solid. R.C.T.

N80-30411 Rocketdyne, Canoga Park, Calif.
ADVANCES IN PROPELLANT PROPULSION TECHNOLOGY FOR INTERMEDIATE RANGE BALLISTIC MISSILE
D. L. Leonard, W. R. Bissell, W. H. Geniec, and I. E. Rosman *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 481-499 Sponsored by General Dynamics/Convair (For primary document see N80-30381 21-20)
Avail: Issuing Activity CSCL 21/8

Currently available liquid propulsion system technology was applied to intermediate range ballistic missiles and shows advantages over solid propellant systems in terms of range, performance, and weight. Design of specific systems was based upon parametric data optimization and new technology data developed for air launched and ground launched ballistic missile systems through in house and contractual studies. Both pressure fed and pump fed liquid propellant systems were studied for a variety of propellant combinations, payload requirements, launch constraints, and missile ranges. Pump fed systems were found to be lighter weight and higher performing than equivalent solid motor systems for both ground launched and air launched missiles. Pump fed system were also found to be smaller and higher performing for the same range and payload requirements than the comparable pressure fed missiles. It was determined that a combined lighter weight tank structure and rocket engine could be used with the pump fed liquid system and propellant carry capability improvements realized through better packaging within the missile's gross weight limit for pump fed systems. R.C.T.

N80-30412 Aerojet Solid Propulsion Co., Sacramento, Calif. Aerojet Tactical Systems.
DEVELOPMENT OF A REDUCED SMOKE ROCKET MOTOR FOR THE AIM-9B, E, J, P SIDEWINDER MISSILE
R. S. Newman and P. L. Smith *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 501-521 ref (For primary document see N80-30381 21-20)
(Contract F04611-76-C-0045)
Avail: Issuing Activity CSCL 21/8

The results of the balance of development and the subsequent qualification program, in which all tests were successfully completed, except hot aging followed by cold firing are described. An extensive company sponsored failure analysis program was conducted in which the cause of the anomalous performance of the aged motors was determined to be hardening of the propellant in the forward section of the motor due to the migration of plasticizer from the propellant into the insulator/liner. Subsequently, sufficient plasticizer was added to the liner to establish a chemically balanced system. Motors made with the modified liner formulation were successfully hot aged and cold fired, qualifying the motor for production. R.C.T.

N80-30413 Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
MACH 3 HYDROGEN EXTERNAL/BASE BURNING
Warren C. Strahle, Douglas H. Neale, and James E. Hubbartt *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 523-543 refs (For primary document see N80-30381 21-20)
(Grant AF-AFOSR-2794-75)
Avail: Issuing Activity CSCL 21/8

Experimental studies of base pressure manipulation for an axisymmetric model at Mach 3 with simulated and actual external/base burning are described. Early work using contoured test section walls and cold gas base region injection is reviewed to demonstrate wake detail and length scale changes under the influence of simulated external/base burning. Tests with actual combustion of radially and axially injected hydrogen are then reported. Outstanding performance values with significant base drag reduction is shown for injection and burning directly in the near wake (base burning). Current attempts at radial injection and burning in the free stream (external burning) have not yet succeeded. These tests, however, have defined an envelope within which external burning, if feasible, is achieved. Author

N80-30414 Textron Bell Aerospace Co., Buffalo, N. Y.
MODULATION OF A GAS GENERATOR
Morton Shorr *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 545-556 refs (For primary document see N80-30381 21-20)
Avail: Issuing Activity CSCL 21/8

A theoretical mathematical examination of gas generator modulation that can be achieved by injecting an oxidizer into the combustion zone of an underoxidized solid propellant grain is presented. The chamber pressure time history is assumed to have a comparable slope with and without injection so that pressure modulation limits define also the mass flow limits.
J.M.S.

N80-30415 Thiokol Corp., Brigham City, Utah. Wasatch Div.
HARM ROCKET MOTOR DEVELOPMENT
In APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 557-567 (For primary document see N80-30381 21-20) (Contracts N00123-74-C-1772; N00123-76-C-0183)
Avail: Issuing Activity CSCL 21/8

The YSR113-TC-1 rocket motor developed for use in the AGM-88A high speed antiradiation missile (HARM) is described. The HARM Weapon System is designed to detect, acquire, display, and select a radiating surface-to-air threat and to launch a missile which will guide to and destroy the threat. The weapon system is employed on A-6, A-7, and F/A-18 aircraft and on the F-4G. Features of the rocket motor discussed are: an envelope 2.12 m (83.5 in) in length and 0.254 m (10.0 in) in diameter; the required impulse in accordance with a prescribed boost/sustain thrust profile; interface with the launcher, control section, and four aerodynamic fins; and a low visual signature during flight.
J.M.S.

N80-30416 Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
POST-LAUNCH RESULTS OF THE TIP SPACECRAFT PULSED-PLASMA MICROTHRUSTERS
Stanley J. Kowal *In its* The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 569-582 refs (For primary document see N80-30381 21-20)
Avail: Issuing Activity CSCL 21/8

Two satellites developed as a part of the Transit Improvement Program (TIP) incorporated microthrusters of the pulsed jet type. These thrusters, also referred to as Teflon solid propellant propulsion systems (TSPPS) are described. The two satellites, known as TIP-II and TIP-III, both had malfunctions which prevented them from achieving full operational capability, but the malfunctions did not prevent a complete and successful test of the operation of the TSPPS including firing of one thruster more than 1.2 million times (about 20% of its operational life).
J.M.S.

N80-30417 Nevada Univ., Reno. School of Mines.
MEASURED AND PREDICTED LASER SIGNAL ATTENUATION THROUGH A SOLID ROCKET PLUME
Eugene Miller, J. W. Connaughton (Army Missile Command), and L. S. Thorn (Army Missile Command) *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 583-593 refs (For primary document see N80-30381 21-20)
Avail: Issuing Activity CSCL 21/8

In response to the need for smokeless solid rockets for a new generation of missiles, smoke was characterized. Laser attenuation through solid rocket plumes was measured in static and flight tests. Modeling of the formation of secondary smoke in the plume and the attenuation of a laser signal through it was conducted. Results are presented comparing predicted and experimental laser signal attenuations for a flight test using a rocket loaded with 87% ammonium perchlorate - 1% Al - HTPB binder.
J.M.S.

N80-30418 Thiokol Corp., Brigham City, Utah. Wasatch Div.
LLMM SRAM 3-D GRAIN STRUCTURAL ANALYSIS c28
A. W. Macbeth *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 595-612 (For primary document see N80-30381 21-20)
Avail: Issuing Activity CSCL 21/8

During the SRAM Longer Life Motor Modification (LLMM) development program, soft and hard propellant areas were found near the propellant-liner-insulation bondline. Structurally, this grain condition was thought to be detrimental. A technique was developed to characterize the mechanical and failure properties of soft and hard propellants. Analyses indicated that an LLMM SRAM grain with soft and hard layer penetrometer readings between 0.7 and 6.2 mm met the SRAM 0.4 MS design criteria. Structural test vehicle (STV) mechanical behavior results showed that the laboratory uniaxial constant strain stress relaxation modulus data did not accurately represent propellant grain behavior during most loading conditions. Conversely, laboratory uniaxial constant strain rate initial tangent modulus or maximum stress secant modulus data did represent grain mechanical behavior. STV deformations were predicted accurately when these data were used. Another STV result showed that near bondline grain soft spots appeared to be averaged or masked out; therefore, the uniform soft layer assumption was found experimentally to be conservative. The LLMM SRAM grain structural adequacy was demonstrated by the absence of failure in three STVs.
J.M.S.

N80-30419 Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio. Fuels Branch.
LIQUID AIRBREATHING MISSILE FUELS: AN OVERVIEW OF PROPERTIES AND APPLICATIONS c28
James R. McCoy *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 613-619 refs (For primary document see N80-30381 21-20)
Avail: Issuing Activity CSCL 21/8

Critical design properties are listed and discussed for the liquid hydrocarbon fuels available for air breathing missile propulsion. Examples are given which demonstrate the steps taken in development of a fuel specification. Current systems using or considering use of these fuels are mentioned. Finally, the origin and significance of tabulated fuel properties are considered.
Author

N80-30420 Dynamics Research Corp., Wilmington, Mass.
OPTIMIZED PROPULSION/GUIDANCE ANALYSIS OF RAMJET POWERED VEHICLES
Fred Goldstein and Anthony Calise (Drexel Univ.) *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 621-633 refs (For primary document see N80-30381 21-20)
(Contract F33615-79-C-2088)
Avail: Issuing Activity CSCL 21/8

An evaluation of the use of singular perturbation methods for developing computer algorithms for on-line optimal control of ramjet powered vehicles is presented. Optimal control solutions using singular perturbation theory (SPT) are derived which incorporate optimal aerodynamic control of turn rate and optimal thrust magnitude control of velocity. Maximum lift coefficient, maximum load factor, minimum and maximum velocity and thrust, and instrumentation related constraints are enforced. Particular attention is given to identifying quantities that can be precomputed and stored (as a function of total energy), thus reducing the onboard computational load. Numerical results are given that illustrate the nature of the optimal intercept flight paths, and which demonstrate the impact on trajectory shaping through use of optimal control techniques.
J.M.S.

N80-30421 Boeing Aerospace Co., Seattle, Wash.
APPLICATION OF AN ADVANCED TRAJECTORY OPTIMIZATION METHOD TO RAMJET PROPELLED MISSILES
S. W. Paris, B. K. Joosten, and L. E. Fink *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 635-650 refs (For primary document see N80-30381 21-20)
Avail: Issuing Activity CSCL 21/8

The mission performance characteristics of ramjet propelled missiles are highly dependent upon the trajectory flown. Integration of the trajectory profile with the ramjet propulsion system performance characteristics to achieve optimal missile performance is very complex. A general computer code (CTOP) is applied to ramjet powered missiles to compute open-loop optimal trajectories. The CTOP employs Chebychev polynomial representations of the states and controls, allowing a transformation of the continuous optimal control problem to one of parameter optimization. With this method, the trajectory boundary conditions are always satisfied. State dynamics and path constraints are enforced via penalty functions. The presented results include

solutions to minimum fuel to climb, and minimum time to target intercept problems. J.M.S.

N80-30422 Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
JANNAF 11TH PLUME TECHNOLOGY MEETING, VOLUME 2
Theodore M. Gilliland, ed. Jul. 1979 233 p refs Conf. held at Redstone Arsenal, Ala., 8-10 May 1979
(Contract N00024-78-C-5384)
(AD-A079647; CPIA-PUBL-306) Avail: Issuing Activity CSCL 21/8

Common problems in plume technology are discussed. Exhaust plume flow field property measurements and predictions, and infrared radiation are emphasized. For individual titles, see N80-30423 through N80-30431.

N80-30423* Physical Dynamics, Inc., La Jolla, Calif.
PLUME INTERFERENCE WITH SPACE SHUTTLE RANGE SAFETY SIGNALS
F. P. Boynton and P. S. Rajaseknar *In* APL JANNAF 11th Plume Technol. Meeting, Vol. 2 Jul. 1979 p 1-25 refs (For primary document see N80-30422 21-20)
(Contract NASB-32528)
Avail: Issuing Activity CSCL 20H

The computational procedure for signal propagation in the presence of an exhaust plume is presented. Comparisons with well-known analytic diffraction solutions indicate that accuracy suffers when mesh spacing is inadequate to resolve the first unobstructed Fresnel zone at the plume edge. Revisions to the procedure to improve its accuracy without requiring very large arrays are discussed. Comparisons to field measurements during a shuttle solid rocket motor (SRM) test firing suggest that the plume is sharper edged than one would expect on the basis of time averaged electron density calculations. The effects, both of revisions to the computational procedure and of allowing for a sharper plume edge, are to raise the signal level near tail aspect. The attenuation levels then predicted are still high enough to be of concern near SRM burnout for northerly launches of the space shuttle. R.C.T.

N80-30424* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PLUME IMPINGEMENT PRESSURE MEASUREMENTS TAKEN DURING SEA LEVEL FIRINGS OF A TOMAHAWK MOTOR
David C. Seymour, Terry F. Greenwood, and Sheldon D. Smith *In* APL JANNAF 11th Plume Technol. Meeting, Vol. 2 Jul. 1979 p 47-78 refs Prepared in cooperation with Lockheed Missiles and Space Co., Huntsville, Ala. (For primary document see N80-30422 21-20)
Avail: Issuing Activity CSCL 21H

Plume impingement pressure and force data taken during a special test program utilizing Tomahawk solid motors are presented. The test program consisted of five firings of a Tomahawk solid propellant rocket motor in which the exhaust plume impinged on a flat plate located 12.2 ft and 17 ft from the nozzle exit plane. A brief description of the plume math model used to generate the mobile launch platform design loads is included. R.C.T.

N80-30425 Aerodyne Research, Inc., Bedford, Mass. Center for Electro-Optical Signature Studies.
HIGH RESOLUTION BAND MODELS: APPLICATION TO THE 4.3 MICROMETER CO2 BAND
Lawrence S. Bernstein, David C. Robertson, and John A. Conant *In* APL JANNAF 11th Plume Technol. Meeting, Vol. 2 Jul. 1979 p 79-93 refs (For primary document see N80-30422 21-20)
Avail: Issuing Activity CSCL 21/8

A general theory for predicting band model parameters for the parallel bands of linear triatomic molecules is used to determine high resolution band model parameters for the 4.3 micrometers CO2 band from 200 - 3000 K. Comparisons are made to experimental data covering this same temperature range. The band model predictions and data are shown to be in good agreement. Application of the high resolution band model parameters to plume emission-atmospheric absorption calculations in the CO2 fundamental band head region (2380 - 24 per cm) is discussed. Line by line and band model plume signature predictions are compared for an aircraft plume over 0, 0.5, and 5 km atmospheric paths. The line by line and band model predictions for the 0 and 0.5 km paths are in good agreement. For the 5 km path, the band model overestimates the atmospheric transmission by a factor of two. The reason for this overprediction is discussed and a correction formula is presented which should extend the accuracy of band model emission-atmospheric absorption predictions to long viewing paths (approximately 20 km at sea level). R.C.T.

N80-30426 Aerodyne Research, Inc., Bedford, Mass. Center for Chemical and Environmental Physics.
A MONTE CARLO SIMULATION OF SOLAR INDUCED FLUORESCENT SCATTERING IN OPTICALLY THICK HIGH ALTITUDE PLUMES
James B. Elgin and Lawrence S. Bernstein *In* APL JANNAF 11th Plume Technol. Meeting, Vol. 2 Jul. 1979 p 95-115 refs (For primary document see N80-30422 21-20)
(Contract F19628-78-C-0145)
Avail: Issuing Activity CSCL 21/8

A high altitude plume is modeled as an infinite cylinder populated with solar absorbing species. Incident solar photons are considered across the Doppler line width of the absorber, and successive absorptions and reemissions are simulated using a Monte Carlo technique. Smooth convergent results are obtained by utilizing a direct determination of spherical harmonics coefficients. Spatial, angular and spectral distributions are presented and discussed for various optical depths and branching ratios. Author

N80-30427* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DIRECT SIMULATION MONTE CARLO METHOD APPLIED TO SHUTTLE FLOW FIELD ANALYSIS
R. A. Outlaw, L. T. Melfi, Jr., F. J. Brock (Old Dominion Univ.), and J. E. Hueser (Old Dominion Univ.) *In* APL JANNAF 11th Plume Technol. Meeting, Vol. 2 Jul. 1979 p 117-146 refs (For primary document see N80-30422 21-20)
Avail: Issuing Activity CSCL 20D

A program for analyzing the flow field in the neighborhood of the orbiting shuttle was developed which uses a probabilistic Monte Carlo technique and is capable of analyzing three dimensional steady or unsteady flow with internal and external boundary conditions. A numerical solution for the flow field is produced which is the probabilistic equivalent of a complete solution for the time dependent, three dimensional Boltzmann equation. The program computes the inward molecular flux at the flow boundaries, both external and internal, and the motion of all molecules within the flow field under the influence of both surface interactions and molecular collisions. The internal boundary is a close approximation of the actual shuttle geometry. The shuttle surface is divided into 38 surface elements for which temperature and outgassing flux density may be independently specified. A typical flow field analysis (including 9 molecular species) for an aft thrust-up VCS engine firing is discussed. Results are compared to engine off results and both are compared to the Woods Hole criteria. A.R.H.

N80-30428* McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
A NOZZLE BOUNDARY LAYER MODEL INCLUDING THE SUBSONIC SUBLAYER USABLE FOR DETERMINING BOUNDARY LAYER EFFECTS ON PLUME FLOWFIELDS
Basil P. Cooper, Jr. *In* APL JANNAF 11th Plume Technol. Meeting, Vol. 2 Jul. 1979 p 147-165 refs (For primary document see N80-30422 21-20)
(Contracts NAS8-21810; NAS8-31644)
Avail: Issuing Activity CSCL 21H

A model for the boundary layer at the exit plane of a rocket nozzle was developed which, unlike most previous models, includes the subsonic sublayer. The equations for the flow near the nozzle exit plane are presented and the method by which the subsonic sublayer transitions to supersonic flow in the plume is described. The resulting model describes the entire boundary layer and can be used to provide a startline for method-of-characteristics calculations of plume flowfields. The model was incorporated

into a method of characteristics computer program and comparisons of computed results to experimental data show good agreement. The data used in the comparisons were obtained in tests in which mass fluxes from a 22.2-N (5 lbf) thrust engine were measured at angles off the nozzle centerline of up to 150 deg. Additional comparisons were made with data obtained during tests of a 0.89-N (0.2 lbr) monopropellant thruster and from the OH-64 space shuttle heating tests. The agreement with the data indicates that the model can be used for calculating plume backflow properties. A.R.H.

N80-30429 Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.

CRITICAL REQUIREMENTS FOR MID-ALTITUDE IR PREDICTIONS

S. Rudman, P. DelGuidice, and R. Ambruso *In* APL JANNAF 11th Plume Technol. Meeting, Vol. 2 Jul. 1979 p 167-185 refs (For primary document see N80-30422 21-20)
(Contract F44620-76-C-0021)
Avail: Issuing Activity CSCL 21/8

It is shown that it is increasingly difficult to predict rocket plume radiation as altitude increases. This is a result of a compounding of the effects of increasing sensitivity of the Planck function to temperature increments and the increasing uncertainty in the temperature predictions as altitude increases. An analysis is used to derive an expression which shows the specific dependence. An analysis is used to derive an expression which shows the specific dependence of station radiation on plume temperature, radiator species mass fraction and temperature profile parameters. One expression successfully reduces all the far field station radiation for two model problems to a single constant. Another relationship is equally successful in the near field region. The analysis is best suited for an optically thin gas, but may not be limited to that case. Major sources of temperature increments or inaccuracies which plume modellers must account for or control include nonideal thermochemical properties, finite rate chemical relaxation, shock heating associated with multiple nozzle exhaust systems and tolerances of numerical calculation schemes. Author

N80-30430 Interstate Electronics Corp., Anaheim, Calif.

MEASURING AND MODELING ROCKET-PLUME DOPPLER SPECTRAL ASYMMETRY IN CW DOWNLINK TRANSMISSIONS

H. I. Sargeant, E. J. Walcek, and W. A. Janos *In* APL JANNAF 11th Plume Technol. Meeting, Vol. 2 Jul. 1979 p 187-209 refs (For primary document see N80-30422 21-20)
(Contract N00030-75-C-0011)
Avail: Issuing Activity CSCL 21/8

Two surface receiving stations, 64 kilometers (40 nautical miles) apart, measured an unmodulated S-band (2,200-MHz), radio frequency (RF) test signal emitted by a Poseidon missile. On site, horizontally and vertically polarized received signals were measured. At the other site, the Range Instrumentation Ship USNS Range Sentinel (TAGM-22), measured left- and right-hand circularly polarized received signals. The nature of rocket plume interactions with the microwave test signal was studied as a function of aspect angle, particularly regarding plasma-induced RF angle modulations. For tailon aspect angles, where severe plume attenuations were evident, Doppler shifts of the plume-induced signal were quantified together with time histories. The results illustrate an apparent multipath effect possibly created by plume-caused shifts in the equivalent phase center of the transmitting array. Phase-shift jitter also was noted during the postboost phase. Predetection tape recordings of the signal were reduced and analyzed by fast Fourier transform and digital filtering techniques. A.R.H.

N80-30431 Concentration, Heat and Momentum Ltd., Surrey (England).

COMPUTER ANALYSIS OF THE BASE-FLOW REGION OF A ROCKET EXHAUST

D. G. Tatchell, N. C. Markatos, and D. B. Spalding *In* APL JANNAF 11th Plume Technol. Meeting, Vol. 2 Jul. 1979 p 211-230 refs Sponsored by the Propellant, Explosives and Rocket Motor Establishment, Westcott, England (For primary document see N80-30422 21-20)
Avail: Issuing Activity CSCL 21/8

The BAFL2 computer code for analyzing the recirculating flow region near the base-wall of a rocket is described. The rocket is assumed to be flying straight ahead, so the flow is treated as axisymmetric. The analysis includes calculation of velocities (two components), pressure, temperature and concentrations of an arbitrary number of reacting chemical species. Effects of turbulence are included via a two equation turbulence model, involving solution of additional transport equations for turbulence kinetic energy and its rate of dissipation. The solution method is a finite difference one. A.R.H.

N80-30432# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.

TECHNIQUE AND MEASUREMENT OF HEAT FLUX AND FLAME TEMPERATURE IN ROCKET PLUME EXPOSURES Final Report

J. R. Piergallini and A. M. Stoll 7 May 1980 12 p refs (WF52852300)
(AD-A086533; NADC-80093-60) Avail: NTIS
HC A02/MF A01 CSCL 06/5

An investigation was performed using model rocket static test engines simulating full scale rocket engine firings with instrumented live animals, heat flux transducers and thermocouples for burn injury assessments. Available data on rocket engine flame temperatures was either extrapolated or computed from chemical compositions and because of the unique 'dirty' characteristics of the flame, it was necessary to devise special instrumentation for direct measurements. A heat flux transducer was fabricated to measure the energy impingent upon the skin surface at various distances from the rocket engine. The transducer was calibrated against a graphite imaging furnace capable of producing 15 cal/sq cm sec, in conjunction with a standard radiation source and radiometer. Radiometric observations were used also to describe precisely the pulse shape of the rocket engine plume. External and intradermal thermocouples measured the actual temperatures experienced in producing a white burn in the rat (equivalent to a second degree burn in the human) and for monitoring each test and correlating one exposure with another. This paper describes the techniques and measurements used, the generation of a time-temperature profile for producing the standard burn effect and provides a temperature history at the level of the burn site. GRA

N80-30433# California Univ., Livermore. Lawrence Livermore Lab.

MODELING PROPELLANT COMBUSTION INTERACTING WITH AN ERODING SOLID SURFACE

A. C. Buckingham (AIAA) 6 May 1980 12 p refs Presented at AIAA-SAE-ASME 16th Joint Propulsion Conf., Hartford, Conn., 30 Jun. - 2 Jul. 1980 Sponsored in part by AROD and U.S. Army ARRADCOM Submitted for publication
(Contract W-7405-eng-48)
(UCRL-83727; CONF-800620-2) Avail: NTIS
HC A02/MF A01

Turbulent combustion flow acting on and influenced by an eroding wall surface was modeled. The combustion flow field is particle laden. Significant particulate mass loading occurs in the immediate neighborhood of the wall as a result of erosion products issuing from the deteriorating solid surface. Cases are also considered in which a substantial particle mass loading develops near the wall as a result of finely divided (sub micron diameter) particulates such as TiO2 and talcum powder which are added to suppress erosion. In addition to statistical turbulent field particle flow interaction, the model includes multi-component molecular diffusion processes, and gas phase, gas/surface and or solid surface chemical reactions. Results indicate that despite the unsteady flow conditions, a limiting erosion rate is approached. This occurs as a result of the effective blowing off of the issing vapor phase products. The blowing reduces the gradients driving the incident combustion heat and mass transfer. DOE

N80-30434# Fulmer Research Inst. Ltd., Stoke Poges (England).

DEVELOPMENT AND TESTING OF CLEANING PROCEDURES AND FEEDING SYSTEMS FOR A FIELD EMISSION THRUSTER MODEL Final Report

D. Stewart and P. Wilson May 1979 188 p refs (Contract ESTEC-2502/75-AK)
(FRI-R664/3; ESA-CR(P)-1305) Avail: NTIS

HC A09/MF A01

Tests were made to determine a successful cleaning procedure for operating the feed system of a field emission thruster using cesium as the propellant. Emission tests using an emitter made from nickel arrays show that cleaning can be achieved without electron or argon ion bombardment. The emitter and accelerator electrode geometry were studied and a high beam transmission, greater than 99%, was obtained. No significant improvement in performance was gained by the use of quadruple arrays or razor blade emitters. Two tests made with gallium as the propellant were unsuccessful due to poor wetting of the emitter.

Author (ESA)

N80-30435# United Kingdom Atomic Energy Authority, Culham (England).

FIELD EMISSION ELECTRIC PROPULSION ION OPTICS OF DOUBLE EDGED MATERIALS Final Report

C. L. Thomas and P. F. Little Dec. 1978 43 p refs

(Contract ESTEC-3308/77-NL-AK(SC))

(CLM-RR/E1/25; ESA-CR(P)-1307) Avail: NTIS HC A03/MF A01

Calculations of some aspects of the ion optics of double edged emitters are reported. The correct source distributions for various beam currents were derived by adjusting the source distributions so as to reproduce current distributions measured experimentally, downstream of the accelerator. The experimental accelerator was modified so that a smooth electrode profile allows 100% transmission of ions. This electrode was further modified to reduce the effect of electron back-bombardment of the emitter. To obtain information about the disposition of the liquid surface within the double emitter, the electric field inside the emitter was computed. The two electrode system was augmented by a decelerator in an attempt to focus the beam. It was found that with the voltage specified, no focusing is possible. Neutralizing electrons are introduced into the beam downstream of the decelerator but only a 3 1/2% reduction in the emergent angle is obtained. Author (ESA)

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N80-30438*# Martin Marietta Corp., Denver, Colo.

EVALUATION AND PREDICTION OF LONG TERM SPACE ENVIRONMENTAL EFFECTS ON NON-METALLIC MATERIALS Quarterly Progress Report

John A. Shepie 8 Jul. 1980 13 p

(Contract NAS8-33578)

(NASA-CR-161545; MCR-80-509-Issue-3; QPR-3) Avail: NTIS HC A02/MF A01 CSCL 07D

Ten materials were evaluated for mechanical and dielectric properties following long term vacuum exposure. Data obtained for these materials is presented in tabular form. T.M.

N80-30437# Oak Ridge National Lab., Tenn. Solid State Div.

STRUCTURAL DEFECTS IN LASER- AND ELECTRON-BEAM ANNEALED SILICON

J. Narayan 1979 14 p refs Presented at the Symp. on the Sci. Basis for Nucl. Waste Management, Boston, 26 Nov. 1979

(Contract W-7405-eng-26)

(CONF-791112-62) Avail: NTIS HC A02/MF A01

Laser and electron beam pulses were used to provide an almost ideal source of heat by which thin layers of semiconductors are rapidly melted and solidified with heating and cooling rates exceeding 10 to the 80th power C/sec. Microstructural modification obtained as a function of laser parameters were examined. It is shown that both laser and electron beam pulses can be used to remove displacement damage, dislocations, dislocation loops and precipitates. Annealing of defects underneath the oxide layers in silicon is possible within a narrow energy window. The formation of cellular structure provides a rather clear evidence of melting which leads to segregation and supercooling and subsequent cell formation. DOE

N80-30438# Computer Corp. of America, Cambridge, Mass.

THE DESIGN OF A SYSTEM FOR PRE-PROTOTYPE USE OF THE CHEMICAL SUBSTANCE INFORMATION NETWORK

Donald A. Eastlake, III, Aren J. Horowitz, and David A. Low 31 Dec. 1979 54 p refs

(PB80-178320; CCA-79-26) Avail: NTIS HC A04/MF A01 CSCL 07D

The design of a system which assists users in the retrieval of related data from remote chemical information systems is presented. The design employs an intelligent terminal to generate commands to and 'capture' output from remote systems, transform data output by one system into input to another system, and 'substitute' data files for keyboard input. It is the first in a series of early Chemical Substances Information Network. GRA

24 COMPOSITE MATERIALS

Includes laminates.

N80-30439 Drexel Univ., Philadelphia, Pa.

STATISTICAL ANALYSIS OF THE FATIGUE OF COMPOSITE MATERIALS Ph.D. Thesis

Harry Richard Miller 1980 138 p

Avail: Univ. Microfilms Order No. 8019353

Several aspects of the problem of defining the statistical distribution function for the fatigue life of composite materials are studied. The maximum likelihood method is employed to obtain the parameter estimating equations for the case where the underlying distribution is a two parameter Weibull and the sample on which the estimation is to be based is doubly progressively censored. An iterative solution scheme for these equations is presented and an example shown. An application to proof testing is also suggested. The maximum likelihood parameter estimating equations are derived for the case where the underlying distribution is composed of two segments, one in the low life region and one in the high life region, where each segment has the form of a two parameter Weibull distribution. A model is developed for the fatigue failure of structures composed of identical elements arranged in parallel. The exact equations for the probability of failure of two and three element parallel systems are derived. Solution of these equations is shown to require multiple numerical integration. An approximate recursion formula is also derived. Dissert. Abstr.

N80-30440 Polytechnic Inst. of New York.

COMPRESSIVE DEFORMATION CHARACTERISTICS OF SOME CEMENTED TUNGSTEN CARBIDES AT ELEVATED TEMPERATURES Ph.D. Thesis

Moon Hyoun Chung 1980 158 p

Avail: Univ. Microfilms Order No. 8019393

High temperature compressive deformation characteristics of three commercial grade cemented tungsten carbides were studied in the temperature range from ambient 900 C. Stress-strain relationships for the three carbides at five different temperatures between room temperature and 850 C were established. Using replica electron microscopy and optical microscopy, the polished and fractured surfaces of the samples, deformed to various degrees at the five different temperatures were analyzed. Dissert. Abstr.

N80-30441*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

OUTGASSING DATA FOR SPACECRAFT MATERIALS

William A. Campbell, Jr., Richard S. Marriott, and John J. Park Aug. 1980 259 p refs

(NASA-RP-1061; Rept-80-F-7000) Avail: NTIS HC A12/MF A01 CSCL 11D

A system for determining the mass loss in vacuum and for collecting the outgassed compounds was developed. Outgassing data, derived from tests at 398 K (125 degrees C) for 24 hours in vacuum as per ASTM E 59577, are compiled for numerous materials for spacecraft use. The data presented are the total mass loss (TML) and the collected volatile condensable materials (CVCM). The various materials are compiled by likely usage and alphabetically. R.K.G.

N80-30442# Illinois Univ. at Urbana-Champaign, Urbana. Dept. of Metallurgy and Mining Engineering.
STRUCTURE AND DEFORMATION CHARACTERISTICS OF RHEOCAST METALS Final Report, 24 Jun. 1976 - 23 Jun. 1979
R. Mehrabian, F. M. Hosking, F. Folgar Portillo, and R. Wunderlin Mar. 1980 95 p refs
(Contract DAAG46-76-C-0046; DA Proj. 1T1-62105-AH-84)
(AD-A086469; AMMRC-TR-80-5) Avail: NTIS HC A05/MF A01 CSCL 11/4

This report describes work aimed at developing wear resistant composites of aluminum base alloys, using rheocasting and associated processes. It is anticipated that the feasibility of use of such composites in track blocks of land vehicles would be subsequently determined. Composites of two wrought (2014 and 2024) and one cast (201) aluminum alloys containing 2 to 30 weight percent of Al2O3 and SiC particles in the size range of the 1 to 142 micrometers were prepared using a compositing apparatus developed in this investigation. The non-metals were successfully added and retained in the aluminum alloy matrices using the rheological properties of a partially solidified, vigorously agitated alloy to advantage. Subsequently, the composites were reheated to above their liquidus temperature, shaped and solidified under high pressure in a forging press. The microstructures, the wear behavior and the mechanical properties of the composites were studied. Composites with particulate additions larger than 5 micrometers in size possessed homogeneous structures. On the other hand, 1 micrometer particles tended to cluster. The wear behavior of the composites was studied on a pin-on-disk type machine built during this investigation. It was shown that composites containing large amounts of non-metals, about 20 wt%, of Al2O3 or SiC exhibit excellent wear resistance and low coefficients of friction. The wear mechanism in the matrices and the composites were also established. GRA

N80-30443# Illinois Univ. at Urbana-Champaign, Urbana. Dept. of Metallurgy and Mining Engineering.
A FUNDAMENTAL STUDY OF A NEW FABRICATION TECHNIQUE FOR FIBER REINFORCED ALUMINUM MATRIX COMPOSITES Final Report, 22 Mar. 1976 - 11 Aug. 1979
R. Mehrabian 20 Apr. 1980 21 p refs
(Grants DAAG29-76-G-0170; DAAG29-78-G-0067)
(AD-A086282; ARO-13847.3-MSX) Avail: NTIS HC A02/MF A01 CSCL 11/4

The feasibility of fabricating fiber-reinforced aluminum alloys by addition of discontinuous fibers to partially solid slurries and completely liquid matrices was investigated. In the first phase of the program, emphasis was placed on the study of interface interactions between polycrystalline Al2O3 fibers and Al-2 to 8%Mg, Al-4.5%Cu and Al-4.5%Cu-1 to 2%Mg alloys produced by the slurry process. In general, it was observed that the incorporation of fibers could be readily achieved by this technique, and that fibers appeared wetted after a few minutes of contact with the melt. The composites produced exhibited an intimate, void free bond between the constituents. In addition, a region of significantly altered microstructure resulted from accumulation of oxide and/or aluminate particles which either formed within the melt and were attached to the moving fibers, or used the fiber surface as a substrate to grow on. Microscopic examination of this interaction zone and thermodynamic considerations indicated that it consisted of fine alpha-Al2O3, aluminates, oxides of the alloying elements, and probably some intermetallic compounds. GRA

N80-30444# Connecticut Univ., Storrs.
FATIGUE BEHAVIOR OF GLASS FIBER REINFORCED POLYBUTYLENETEREPHTHALATE Final Report, May 1978 - Apr. 1979
A. T. DiBenetto Apr. 1980 77 p refs
(Contract DAAG46-78-C-0027; DA Proj. 1L1-62105-AH-8H)
(AD-A087104; AMMRC-TR-80-17) Avail: NTIS HC A05/MF A01 CSCL 11/4

The fatigue behavior of short glass fiber reinforced PBT composites has been investigated under different environmental conditions. Exposure to water at high temperature causes embrittlement, while improved processing and exposure to high humidity cause an increase in ductility. The fatigue life is a function of the environmental conditioning, the stress level of the test and the ductility of the material. The quantity (Theta (max)/- Theta -)2 1n t(B) is independent of environmental conditioning and increases with increasing ductility. The total deformation-to-break during fatigue consists of a deformation attributable to cyclic softening and a longer term deformation that continues at nearly constant rate until failure occurs. The cyclic softening is associated with cyclic stress-strain characteristics, while longer term deformation is controlled by creep and microcavitational phenomena. Crack propagation rates in notched plates were measured. The crack propagation behavior was somewhat dependent on the stress history of the material. GRA

N80-30445# California Univ., Livermore. Lawrence Livermore Lab.
DEVELOPMENT OF ALTERNATE SILICONE POTTING COMPOUNDS. VOLUME 6: DEVELOPMENT OF SECONDARY ALTERNATES FOR DOW CORNING'S AEROSPACE SEALANT, DC93-119
W. E. Cady and A. T. Buckner 2 Feb. 1980 29 p refs
(Contract W-7405-eng-48)
(UCRL-52434-Vol-6) Avail: NTIS HC A03/MF A01

A substitute for Dow Corning's DC-93-119 silicone compound can be formulated from Sylgard 184, dielectric gel Q3-6527, and either accelerator QCF3-6559 or DC1107 fluid. Also, a substitute can be formulated from Sylgard 186, dielectric gel Q3-6527, and accelerator QCF3-6559 because the system is not fast enough with QCF3-6559; although, it can be speeded up with the addition of DC1107, the level of extractables is unacceptably high. DOE

N80-30446# Sandia Labs., Albuquerque, N. Mex.
WIND-TUNNEL AND FLIGHT TESTS OF ABLATORS AND INSULATORS FOR ROCKET VEHICLES
Robert E. Sheldahl, Sam G. Beard, Jr., Irving Auerbach, and Thomas F. Covert Apr. 1980 30 p refs Presented at 26th Intern. Instrumentation Symp., Seattle, 5-8 May 1980
(Contract EY-76-C-04-0789)
(SAND-80-05230; CONF-800502-12) Avail: NTIS HC A03/MF A01

Some high performance rocket systems experience enough aerodynamic heating aft of the nose cone to require thermal protection to keep the temperature of the structure below allowable limits. Results of rocket tests and wind tunnel tests indicate that any of the 10 materials tested could provide the required thermal protection for the payload and motor of a rocket system for the environments studied. The temperatures of the cork phenolic showed two entirely different responses. In the wind tunnel, the material apparently burned and produced the highest structure temperatures. On the Terrier-Malemut rocket test, it proved the best insulator, probably as a result of the low oxygen content in the boundary layer. This indicates that cork phenolic works very well for this type of test, but for a rocket launched in a shallow trajectory, the cork phenolic may react more as it did in the wind tunnel. Cork phenolic may prove very effective where a char is of no consequence and the vehicle trajectory is not shallow. DOE

N80-30447# Utah Univ., Salt Lake City. Div. of Materials Science and Engineering.
IMPURITY EFFECTS ON THE CREEP OF POLYCRYSTALLINE MAGNESIUM AND ALUMINUM OXIDES AT ELEVATED TEMPERATURES Technical Progress Report, 19 Dec. 1978 - 18 Dec. 1979
Ronald S. Gordon Dec. 1979 20 p refs
(Contract EY-76-S-02-1591)
(COO-1591-34) Avail: NTIS HC A02/MF A01

Research is described on: the effect of mixed transition metal impurities (Fe-Ti, Mn-Ti, and Mg-Ti) on the steady state creep of polycrystalline aluminum oxides; stress relaxation deformation studies on polycrystalline MgO and Al2O3, pure and doped with iron; and the theoretical analysis of ambipolar diffusion taking into account interfacial defect creation and/or annihilation processes at grain boundaries, and impurity effects, particularly those with mixed dopants. The diffusional creep of polycrystalline alumina can be completely explained provided Schottky defects are assumed to be the intrinsic defects in Al2O3. DOE

N80-30448# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
DEPENDENCE OF SILICON CARBIDE COATING PROPERTIES ON DEPOSITION PARAMETERS: PRELIMINARY REPORT
R. J. Lauf and D. N. Braski May 1980 35 p refs
(Contract W-7405-eng-26)
(ORNL/TM-7209) Avail: NTIS HC A03/MF A01

The effects of deposition variables on the structure and properties of the SiC layer in fission fuel particles are investigated. The silicon carbide is deposited by the thermal decomposition of methyltrichlorosilane in an excess of hydrogen. The grain size and shape depend on coating rate and deposition temperature. The fine structure of the coating, observed at the submicrometer level by transmission electron microscopy, has been found to vary in the same way as does the general microstructure observed optically. X ray diffraction has shown the presence of one or more polytypes of alpha-SiC in coatings deposited at relatively low temperatures and/or relatively high coating rates. The coating density and surface morphology are strongly dependent on deposition temperature and coating rate. The best surface appearance is observed in those coatings that have the highest density. DOE

N80-30449# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
ADVANCED ELECTRON BEAM TECHNIQUES FOR METALLIC AND CERAMIC PROTECTIVE COATING SYSTEMS
Donald H. Boone and John W. Fairbanks Feb. 1980 27 p refs Presented at the ASM/SAMPE Conf. on Specialized Cleaning, Finishing and Coating Processes, Los Angeles, 5 Feb. 1980
(Contract W-7405-eng-48)
(LBL-10520; CONF-800235-1) Avail: NTIS HC A03/MF A01

The need for protective coatings in energy conversion equipment operating at high temperatures with nonpetroleum alternative fuels is discussed. The development of electron beam evaporation physical vapor deposition (EB-PVD) processes for applying such ceramic coatings is described, and current research is reviewed. It is concluded that the needs for the use of protective coatings will continue to increase as our quest for greater energy efficiency and more diversified fuel sources expands. Overlay coatings and composite system will be required to meet these requirements in a cost effective manner consistent with materials availability. These needs spurred interest and activity in the overlay coating processing area in general and in EB-PVD techniques in particular where even greater activity is predicted in the future. DOE

N80-30450# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
COMPARISON OF QUASI-ISOTROPIC FIBER REINFORCED COMPOSITE LAMINATES
John C. Duke, Jr. Nov. 1979 125 p refs
(Contract W-7405-eng-48)
(UCRL-15225) Avail: NTIS HC A06/MF A01

Because preliminary tests on composite laminate rotors for flywheels indicated that nominally quasi-isotropic laminates were reasonably isotropic with regard to stiffness, but that the strength values differed by 40% depending on direction, tensile, ultrasonic, and acoustic emissions tests were conduted on specimens of graphite-epoxy, S-2 glass epoxy, and Kevlar 49 epoxy composite systems. Results are presented. DOE

N80-30451# Ecole Nationale Superieure de Techniques Avancees, Paris (France).
[TECHNICAL RESEARCH ACTIVITIES FOR 1978] Annual Report [RAPPORT D'ACTIVITES SUR LES RECHERCHES A L'ECOLE NATIONALE SUPERIEURE DE TECHNIQUES AVANCEES EN 1978]
1979 101 p refs In FRENCH
Avail: NTIS HC A06/MF A01

Laboratory research and pedagogical applications are reported in chemistry and physics, thermochemical combustion, computer sciences, materials science, ellipsometry and composite materials structures, and fluid mechanics (naval and oceanographic applications). Applied optics, specifically, time resolution spectroscopy is also considered. Author (ESA)

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also 77 Thermodynamics and Statistical Physics.

N80-30452 Delaware Univ., Newark.
A LOW TEMPERATURE SPECIFIC HEAT STUDY OF SOME DISORDERED ALLOY SYSTEMS Ph.D. Thesis
Patrick Francis Gleeson, Jr. 1980 131 p
Avail: Univ. Microfilms Order No. 801932

The specific heat of some crystalline and amorphous alloy systems was measured in the temperature range 0.5-30 K. Two ternary platinum-based crystalline alloy systems, Pt/r-Au and Pt-Rh-Au are studied and changes in the electronic contribution of the specific heat are discussed in the context of several models. The specific heat of the metallic glass Fe40Ni40P1486 is compared to the specific heat of the same alloy measured after each of two successive annealing processes, where care was taken to avoid recrystallization temperatures. Changes in the electronic and lattice contributions are discussed in terms of short range ordering models. Dissert. Abstr.

N80-30453 California Inst. of Tech., Pasadena.
SHOCK TEMPERATURES OF MATERIALS: EXPERIMENTS AND APPLICATIONS TO THE HIGH PRESSURE EQUATION OF STATE Ph.D. Thesis
Gregory Allen Lyzenga 1980 214 p
Avail: Univ. Microfilms Order No. 8021025

Temperature measurements obtained during impact driven shock wave experiments with solid and liquid samples at pressures near 100 GPa are reported and discussed. Experimental results confirm that throughout moderate ranges of shock pressure amplitude, transparent dielectrics emit thermal radiation from the region of the shock front, with a spectrum which is characteristic of the Hugoniot state temperature. Shock temperatures in sodium chloride crystals have been measured in the pressure range 70 to 105 GPa. The observed temperatures, between 4000 and 8000 K, are in agreement with the results of earlier determinations and with calculations assuming the occurrence of shock induced melting. Results of experiments to measure shock temperatures in metallic silver include a successful measurement of 5950 K at a pressure of 185 GPa. Shock temperature measurements in silica (SiO2) produced anomalous results suggestive of melting occurring in the stishovite phase near 100 GPa pressure and 4700 K temperature. Experimental measurements with alpha quartz, fused silica samples single crystal forsterite, and water are also discussed. Dissert. Abstr.

N80-30454 California Inst. of Tech., Pasadena.
NON-STEADY BEHAVIOR OF A FLAME SPREADING FROM A POINT IN A TWO-DIMENSIONAL DUCT Ph.D. Thesis
Malladi Venkata Subbaiah 1980 134 p
Avail: Univ. Microfilms Order No. 8020431

Non-steady behavior of a flame stabilized in a two dimensional duct was studied. The problem was formulated by an integral technique in which the governing equations were integrated across the duct to obtain integral relations for the mean flow variables. The flow on either side of the flames sheet were matched by appropriate matching conditions. Fluid flow through the flame surface caused the integral relations to explicitly involve the fluid velocities at the flames. An independent description of the flame shape and the irrotational flow field upstream of the flame was provided by a source distribution on the duct axis. The integral relations were analyzed by perturbation technique, in which the dominant order solution represents the steady flame development. The steady flame configuration was perturbed by an acoustic wave incident on the compact flame region. The time dependent counterpart of the integral relations describes the ensuing non steady flow fields. The flame perturbation describes the ensuing non steady flow fields. The flame perturbation exibited a traveling wave pattern with considerable amplification along the flame zone. Dissert. Abstr.

N80-30455 Minnesota Univ., Minneapolis.
STRUCTURE AND PATHOLOGY OF THE STEADY STATE, STABILITY AND DYNAMICS OF THE COMBUSTION OF AN IMPERVIOUS CARBON PARTICLE Ph.D. Thesis
Eduardo Mon 1979 201 p
Avail: Univ. Microfilms Order No. 8019550

A model of diffusion and reaction based on the Stefan-Maxwell equations was constructed for the stagnant boundary that surrounds a carbon particle during combustion. The model included the heterogeneous combustion reactions in concert with radiation as nonlinear boundary conditions. Using the stoichiometric coupling of the molar fluxes, the problem was reduced to a single conservation equation that results from the homogeneous oxidation of carbon monoxide. The effects of various parameter values on the solution were examined. In particular, variation of the particle size provide conclusions as to whether or not a carbon monoxide flame develops in the boundary layer. A simplified transient model was used to develop local asymptotic stability criteria for analysis of the multiple steady states. A special case arose when carbon monoxide burned outside the boundary layer as the linearized conservation equations were then solvable by a finite Fourier transform. In the more general case, results were obtained by Galerkin's method. Regions of instability created by variation of the particle size and ambient oxygen concentration were investigated. Dissert. Abstr.

N80-30456 Princeton Univ., N. J.
PYROLYSIS AND OXIDATION KINETIC MECHANISMS FOR PROPANE Ph.D. Thesis
Donald Jerome Hautman 1980 266 p
Avail: Univ. Microfilms Order No. 8018658

The reaction kinetics of complex paraffins were investigated. The experiments were performed in a high temperature, adiabatic, turbulent flow reactor. Spatial chemical sampling and temperature measurements were made using an instrumented probe. The composition of the chemical samples was determined using a gas chromatograph. The kinetic analysis employed both overall and elementary reaction mechanisms. Pyrolysis and oxidation kinetics were investigated since both processes can be present in combustion phenomena. Overall and elementary kinetic descriptions of the pyrolysis of C3H8 were proposed. The overall rate of C3H8 disappearance was described by a first order rate expression. This rate expressions agrees with previously reported rate data. Dissert. Abstr.

N80-30457 Minnesota Univ., Minneapolis.
STUDIES OF CONTINUOUS CHROMATOGRAPHIC REACTORS Ph.D. Thesis
Byong Kwon Cho 1980 274 p
Avail: Univ. Microfilms Order No. 8019517

Theoretical numerical and experimental investigations of continuous chromatographic reactors were conducted. In the first part, the steady state behavior of a countercurrent chromatographic reactor was analyzed mathematically for a reversible reaction adsorption system occurring in an ideal chromatographic reactor in which negligible axial diffusion and instantaneous adsorption equilibrium are assumed. In the second part, a continuum model for the reaction in a rotating annular reactor under ideal chromatographic conditions was set up, assuming the reactor bed, packed with catalyst and/or adsorbent particles, can be treated as a homogeneous continuum. The resulting hyperbolic system of quasilinear first order particle differential equations was solved using Lax first order finite difference method. Comparisons of numerically simulated reactor performance with experimental results showed good agreement, although some differences occurred as experimentation proceeded, most probably due to deactivation of the adsorbent, activated charcoal. Dissert. Abstr.

N80-30458*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PRESSURE DEPENDENCE OF THE ABSOLUTE RATE CONSTANT FOR THE REACTION OH + C2H2 FROM 228 TO 413K
J. V. Michael, D. F. Nava, R. P. Borokowski, W. A. Payne, and L. J. Stief Jul. 1980 25 p refs Submitted for publication
(NASA-TM-80743) Avail: NTIS HC A02/MF A01 CSCL 07D

The pressure dependence of absolute rate constants for the reaction of OH + C2H2 yields products has been examined at five temperatures ranging from 228 to 413 K. The experimental techniques which was used is flash photolysis-resonance fluoresence. OH was produced by water photolysis and hydroxyl resonance flurorescnet photons were measured by multiscaling techniques. The results indicate that the low pressure bimolecular rate constant is 4 x 10 the the minus 13th power cu cm molecule (-1) s(-1) over the temperature range studied. A substantial increase in the bimolecular rate constant with an increase in pressure was observed at all temperatures except 228 K. This indicates the importance of initial adduct formation and subsequent stabilization. The high pressure results are well represented by the Arrhenius expression (k sub bi) sub infinity = (6.83 + or - 1.19) x 10 to the minus 12th power exp(-646 + or - 47/T)cu cm molecule (-1)s(-1). The results are compared to previous investigated and are theoretically discussed. The implications of these results on modeling of terrestrial and planetary atmospheres and also in combustion chemistry are discussed. Author

N80-30459# Texas Univ. at Austin. Dept. of Electrical Engineering.
NEW NONLINEAR OPTICAL PROCESSES IN MOLECULES AT INFRARED FREQUENCIES Annual Report, 30 Sep. 1978 - 29 Sep. 1979
Michael F. Becker 1 Nov. 1979 32 p refs
(Grant AF-AFOSR-3712-78)
(AD-A086206; AFOSR-80-0465TR; AR-1) Avail: NTIS HC A03/MF A01 CSCL 07/4

This report details progress in the study of optical nonlinearities in molecules at infrared wavelengths. The objectives have been to investigate triply resonant third harmonic generation and singly, two photon resonant third harmonic generation. In the first area, the limiting process of multiphoton absorption has received emphasis. In the second area, work has concentrated on molecules which have very strong, narrow, two photon resonances. The successful application of third harmonic generation techniques to study collisionless multiphoton excitation in sulfur hexafluoride was accomplished. Depending on the excitation frequency, one or two photon processes have been identified which deplete the population of the discrete vibrational energy levels into the quasi-continuum. Similar third harmonic generation experiments have yielded lower conversion efficiency in ammonia than in sulfur hexafluoride. Only a single rotational level in ammonia is found to be resonant, so the susceptibility is only minimally enhanced. In the area of two photon resonant molecules, the susceptibility and projected conversion efficiency has been calculated for deuterated methane. Because of the very narrow and strong two photon resonance, the calculated third harmonic conversion is larger than has been observed in any gas phase molecule to date. GRA

N80-30460# Syracuse Univ., N. Y. Dept. of Chemical Engineering and Materials Science.
SURFACE PHYSICS AND CHEMISTRY OF ELECTRICAL CONTACT PHENOMENA Annual Report, 1 Oct. 1979 - 31 Aug. 1980
Richard W. Vook 1 Jun. 1980 30 p refs
(Contract N00014-79-C-0763)
(AD-A086733) Avail: NTIS HC A03/MF A01 CSCL 07/4

The vacuum surface segregation of impurities on copper slip ring materials was studied by Auger electron spectroscopy. In addition the surface chemical composition, electrical contact resistance, and friction were measured in situ for a copper slip ring rotating in vacuum against two copper wire brushes running in separate tracks. The results are embodied in reprints and preprints of 4 papers attached as appendices to the report. GRA

N80-30461# Southwest Research Inst., San Antonio, Tex. Army Fuels and Lubricant Research Lab.
DETERMINATION OF AROMATICITY OF FUELS AND LUBRICANT BASESTOCKS BY ULTRAVIOLET SPECTROSCOPY Interim Report, Jan. 1977 - Feb. 1980
Frank M. Newman and Marvin K. Greenberg Feb. 1980 26 p refs Presented at the Conf. on Anal. Chem. and Appl. Spectry., Pittsburgh, Mar. 1978
(Contracts DAAK70-78-C-0001; DAAK70-80-C-0001)

(AD-A086654; AFLRL-103) Avail: NTIS HC A03/MF A01 CSCL 07/4

A rapid and inexpensive ultraviolet spectroscopic method for determining the aromaticity of turbine and diesel fuels and of lubricant basestocks has been developed. The method employs fixed cells of 0.010, 0.10, and 1.00 cm pathlength in which a sample spectrum is obtained in the 190 to 350 nm region. Absorbance values at several wavelengths and simple matrix calculations yield weight percent ring carbon in substituted benzenes, napthalenes, and phenanthrenes/anthracenes. The precision and accuracy of the method are good for both standards and fuel blends. The method is currently in use for correlation work in both turbine combustors and diesel engines. A large number of virgin and re-refined lubricant basestocks have been analyzed and the results compared to those from other methods. The UV data are more detailed and are believed to be more reliable and accurate. GRA

N80-30462# Locus, Inc., State College, Pa.

INSTRUMENTATION FOR DETECTING HAZARDOUS MATERIALS Final Report, Jun. 1979 - Jun. 1980

Gerard J. Gross, David E. Harris, Gerard Lachs, and Robert M. Dillman Jun. 1980 261 p refs

(Contract DCPA01-79-C-0305)

(AD-A086467; Rept-940-4) Avail: NTIS HC A12/MF A01 CSCL 17/5

The status of material sensing technology as it might be applied to the detection and identification of hazardous materials is reviewed. The scope of types of hazards includes toxic, fire, and explosion hazards but not nuclear radiation hazards. A list of 115 materials considered to pose significant hazards in emergency operations is derived. Then both remote and nonremote instrument types are evaluated, with emphasis on their potential application for development of a portable detection instrument. Though no instrument exists now in a form ready to use for the role studied here, several types show promise for future development: a remote passive IR absorption instrument, a nonremote dispersive IR analyzer, and a nonremote portable gas chromatograph/mass spectrometer. A number of instrument types for purposes other than primary identification are also reviewed and comments made on application and future development. An extensive list of references on material sensing technology is included. GRA

N80-30463# Virginia Univ., Charlottesville. Dept. of Chemistry.

TRANSITION METAL-PROMOTED OXIDATIVE FUSION WITH CARBORANE AND BORINE ANIONS. SYNTHESIS OF C4B SUB n (N = 8-11) CARBORANE SYSTEMS IN THE PRESENCE OF B5H8(-) OR B-3H8(-) IONS

Narayan S. Hosmane and Russell N. Grimes Jul. 1980 39 p refs Submitted for publication

(Contract N00014-75-C-0305; NR Proj. 053-569)

(AD-A087252; TR-33) Avail: NTIS HC A03/MF A01 CSCL 07/2

Simultaneous treatment of CoCl2 or FeCl2 with the (CH3)2C2B4H5)- and (B5H8)- ions in THF at room temperature gave mixed-ligand metallacarborane complexes. In the iron-borane-carborane reaction the order of addition of reagents is important; thus, treatment of FeCl2 initially with (B5H8)- followed later by ((CH3)2C2B4H5)- gave species identified mass spectroscopically as [(CH3)2C2B5H5]2FeH2 and (CH3)4C4B10H10, neither of which was observed in the previously described 'simultaneous' reaction. GRA

N80-30464# Air Force Academy, Colo. Directorate of Chemical Sciences.

CHEMILUMINESCENT REACTIONS OF SELENIUM AND TELLURIUM WITH FLUORINE

William G. Thorpe Apr. 1980 217 p refs

(AF Proj. 2303)

(AD-A087202; FJSRL-TR-80-0010) Avail: NTIS HC A10/MF A01 CSCL 07/4

The Group VI elements, selenium and tellurium, are found to react with fluorine emitting a broad spectral chemiluminescence. The chemiluminescence is characteristic of that emitted by a diatomic molecule. The proposed emitting species are SeF and TeF. Selenium reacts with fluorine with a weak chemiluminescence in the visible between 3800 A and 8900 A. Identical spectra are obtained regardless of whether the source of selenium is the elemental vapor or hydrogen selenide. In the hydrogen selenide/fluoride reaction, vibrationally excited HF is produced with the identified bands: (4,0), (5,1), (6,2), and (3,0) superimposed on the SeF chemiluminescence. GRA

N80-30465# Naval Research Lab., Washington, D. C. Combustion and Fuels Branch.

CATALYTIC OXIDATION OF CARBON MONOXIDE AT HIGH HUMIDITY AND LOW TEMPERATURE Interim Report

J. K. Musick and F. W. Williams 10 Jun. 1980 19 p

(AD-A087206; AD-E000475; NRL-8397) Avail: NTIS HC A02/MF A01 CSCL 07/4

Two catalysts (hopcalite and palladium) were tested for efficiency in promoting oxidation of carbon monoxide (CO). The catalysts were tested using air at 21,000 per h to the minus 1 space velocity, 50% relative humidity, and various temperatures. The air was contaminated with approximately 100 ppm each of methane, dichlorofluoromethane (R-12), and dichlorotetrafluoroethane (R-114) in addition to approximately 5000 ppm of CO. Hopcalite was further tested under similar conditions except that the air was at 100% relative humidity. There is little difference in the efficiencies of hopcalite and palladium catalyst for oxidizing CO at 57 to 62 C; both are low. At 119 to 122 C, the palladium is more efficient than hopcalite. The simultaneous presence of three other contaminants decreased the efficiency of both hopcalite and palladium for oxidizing CO. With the hopcalite preheated to about 119 C, the heat of reaction is not sufficient to maintain the oxidation of CO under the conditions tested. The minimum temperature at which hopcalite and palladium catalysts will completely oxidize CO under the conditions tested is in the 70 to 100 C range. GRA

N80-30466# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.

FORMATION AND CONTROL OF FUEL-NITROGEN POLLUTANTS IN CATALYTIC COMBUSTION OF COAL-DERIVED GASES Quarterly Technical Progress Report, 15 Dec. 1978 - 15 Mar. 1979

F. V. Bracco, C. Bruno, B. Kim, D. A. Santavicca, J. H. Semler, and P. M. Walsh 1 Apr. 1979 55 p refs

(Contract EF-77-S-01-2762)

(FE-2762-7) Avail: NTIS HC A04/MF A01

Computed axial and radial gas temperature and carbon monoxide concentration profiles inside a catalyst channel during carbon monoxide combustion are presented. The integrated carbon monoxide concentration profiles at the exit are compared with experimentally measured values. The resonance absorption and Raman scattering techniques for measuring gas temperature and species concentration are summarized. DOE

N80-30467# National Academy of Sciences - National Research Council, Washington, D. C.

SYMPOSIUM ON ATOMIC SPECTROSCOPY

1979 221 p refs Presented at the SAS-79 Symp. on Atomic Spectry., Tucson, Ariz., 10 Sep. 1979

(Contract DE-AC02-79ER-10460)

(DOE/ER-10460/1; CONF-790997) Avail: NTIS HC A10/MF A01

Abstracts of several presentations addressing developments in atomic spectroscopy are given. Topics covered include: fast beam spectroscopy; astrophysical and other spectra; highly ionized spectroscopy; complex spectra; Rydberg levels; fine structure, hyperfine structure and isotope shift; lineshapes; lifetimes, oscillator strengths and Einstein coefficients; and spectroscopy with lasers. DOE

N80-30468# Thomson-CSF, Orsay (France). Lab. Central de Recherches.

PERFECTING OF NUCLEAR MICROANALYSIS OF DEUTERIUM BY MEANS OF ION IMPLANTATION. APPLICATION TO THE STUDY OF THE HYDROGENATION OF AMORPHOUS SILICON THROUGH IONIC IMPLANTATION Final Report [MISE AU POINT DE LA MICROANALYSE NUCLEAIRE DU DETERIUM A L'AIDE D'UN IMPLANTEUR D'IONS ET SON APPLICATION A L'ETUDE DE L'HYDROGENATION DE SILICIUM AMORPHISE PAR IMPLANTATION IONIQUE]

D. Dieumegard and D. Dubreuil 1979 80 p refs In FRENCH
(Contract DGRST-77-7-1650)
Avail: NTIS HC A05/MF A01

The technique of nuclear microanalysis of deuterium by means of the reaction D (3He, p)4He was perfected on an ion implantor of 400 kV. The sensitivity of the method was about 10 to the 13th power deuterium atoms /sq cm, for an analytical depth of 5000 A in silicon for a three minute experiment. This technique was applied to the study of the hydrogenation of amorphous silicon, by means of ionic implantation and in a deuterium plasma. Kinetics of the trapping of deuterium were measured between ambient temperature and 460 C. The measurements of the concentration outline allow the determination of the diffusion coefficient of the deuterium in amorphous silicon. The thermal stability of the deuterium in the layers was also studied.
Author (ESA)

N80-30469# National Bureau of Standards, Washington, D.C. National Engineering Lab.
FLAMMABILITY TESTING OF SOLIDS UNDER THE FEDERAL HAZARDOUS SUBSTANCES ACT Final Report, 1974 - 1975
Richard D. Peacock and Marianne P. Vaishnav Apr. 1980 93 p refs Sponsored in part by Consumer Product Safety Commission
(PB80-179047; NBSIR-78-1580) Avail: NTIS HC A05/MF A01 CSCL 13L

Experimental work performed for the improvement of test methods for shredded or slit films, powders, pastes, and granular substances, and for extremly flammable solids is discussed.GRA

N80-30470# Oklahoma Univ., Norman. School of Aerospace, Mechanical and Nuclear Engineering.
COMBUSTION OF DROPS AND SPRAYS OF NO. 2 DIESEL OIL AND ITS EMULSIONS WITH WATER AND METHANOL. VOLUME 1: EXPERIMENTAL Final Report, Jul. 1978 - Aug. 1979
S. R. Gollahalli, M. L. Rasmussen, and S. J. Moussavi Jan. 1980 231 p refs 2 Vol.
(Contract DOT-RC-82011)
(PB80-178213; OU-AMNE-79-15-Vol-1; DOT/RSPA/DPB-50-80/1-Vol-1) Avail: NTIS HC A11/MF A01 CSCL 21G

The combustion behavior of No. 2 diesel oil and its emulsions with water and methanol is examined experimetally. The experiments are carried out in three parts: a study of stability and microstructure of emulsions, single drop combustion studies, and spray combustion studies. The results show that unsupported drops of No. 2 diesel oil emulsions with water and methanol undergo disruption during combustion and the fragmentation activity depends on emulsion and ambient variables. The ignition and pollutant emission characteristics of No. 2 diesel oil sprays also are seen to be affected by emulsification. GRA

N80-30471# Oklahoma Univ., Norman. School of Aerospace, Mechanical and Nuclear Engineering.
COMBUSTION OF DROPS AND SPRAYS OF NO. 2 DIESEL OIL AND ITS EMULSIONS WITH WATER AND METHANOL. VOLUME 2: THEORETICAL Final Report, Jul. 1978 - Aug. 1979
M. L. Rasmussen and S. R. Gollahalli Jan. 1980 131 p refs 2 Vol.
(Contract DOT-RC-82011)
(PB80-178221; OU-AMNE-79-16-Vol-2; DOT/RSPA/DPB-50-80/2-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 21G

The combustion behavior of No. 2 diesel oil and its emulsions with water and methanol is analyzed theoretically. Two theoretical models to analyze the variation of drop temperature with emulsion parameters are developed. The differential model considers the diffusion and specific heat effects inside the composite emulsion drop. The integral model does not consider the temperature variation inside the drop. Analytic solutions for both models are developed assuming constant properties. The integral model is also solved numerically considering the variation of properties and using some empirical input data. Both models predict the variation of drop disruption time with the internal phase content in qualitative agreement with the experimentally measured values for the drops of No. 2 diesel oil-water emulsion with water volume fractions up to 0.20. GRA

N80-30472# Membrane Systems, Inc., San Diego, Calif.
DEVELOPMENT OF REVERSE OSMOSIS MEMBRANE FOR SEAWATER DESALINATION Final Report
Richard G. Sudak, James B. Bott, Ronald L. Fox, Susan J. Gagner, and Max E. McKee Sep. 1979 118 p
(Contract DI-14-34-0001-8523)
(PB80-182090; WB0-04802) Avail: NTIS HC A06/MF A01 CSCL 07D

Composite reverse osmosis membranes were formed with a polysulfone porous substrate. The membrane barrier layer was formed by the interfacial polycondensation of polyethylenimine and isophthaloyl chloride. The barrier layer was capable of single stage seawater desalination in that selected membrane samples had a flux of 17 GFD and a rejection of 99%. Asymmetric polyimide membrane was developed further by optimization of casting formulations and conditions. When tested, the best results were 5.8 GFD and 98.4% rejection. A composite membrane barrier layer was formed on polysulfone substrate interfacially with poly(epichlorohydrin-secondary diamines) and isophthaloyl chloride. The best results were 9.6 GFD and 95% rejection.GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N80-30473 Rensselaer Polytechnic Inst., Troy, N. Y.
FATIGUE OF Ni-Al-Mo ALIGNED EUTECTICS Ph.D. Thesis
John Michael Tartaglia 1980 242 p
Avail: Univ. Microfilms Order No. 8020416

The influence of test temperature, environment frequency and heat treatment on fatigue resistance of two nickel-aluminum-molybdenum (gamma/gamma prime-alpha) aligned eutectics, Ni-17.7 w%Al - 16.3% Mo, designated AGI5, and Ni-14.4% Al-20% Mo, designated AG34, were determined. Both alloys were tested in high cycle tension-tension fatigue at 25 C and 825 C. Testing at room temperature was performed in air and in vacuum. All tests were performed at 20 hz except that AGI5 was tested at 20.2 and 0.2 hz. Cracks at 725 C were surface initiated, while fractures at 825 C originated within the specimen cross section, suggesting the possbility of a creep fatigue interaction at 825 C. Both alloys reveal stage 2 cracking at elevated temperature; AGI5 has lower fatigue resistance at 725 C when the test frequency is decreased. Dissert. Abstr.

N80-30474 Rensselaer Polytechnic Inst., Troy, N. Y.
THE INFLUENCE OF COHERENCY STRAINS ON THE ELEVATED TEMPERATURE MECHANICAL BEHAVIOR OF Ni-15Cr-Al-Ti-Mo ALLOYS Ph.D. Thesis
Douglas Arthur Grose 1980 281 p
Avail: Univ. Microfilms Order No. 8020405

The effect of changes in weight traction gamma prime on the minimum of steady-state creep rate was investigated. The temperature dependence of coherency strain as represented by the gamma-gamma prime mismatch was determined over the temperature range 25 C to 800 C by X-ray diffraction. Elevated temperature tensile tests were performed on single-phase, control alloys. Steady state creep data was obtained at 0.58 Tm for selected alloys following peak-aging and 500 hour aging heat treatments at 760 C. Transmission electron microscopy was employed to characterize the deformation substructures and to establish mechanical property-structure relationships. The flow stress increment due to precipitation of gamma prime when normalized by the weight fraction of gamma prime was found to be linearly correlated to the magnitude of gamma-gamma prime mismatch over the temperature inteval 25 C to 800 C. The linear correlation was strongest for high gamma-gamma prime misfit alloys regardless of the antiphase boundary energy (APBE). Dissert. Abstr.

N80-30475 Notre Dame Univ., Ind.
HYDROGEN-RELATED PHENOMENA IN A NICKEL-BASE ALLOY Ph.D. Thesis
Richard James Coyle 1980 163 p
Avail: Univ. Microfilms Order No. 8020958

A series of hydrogen related phenomena which influence embrittlement processes were examined. These phenomena included the influence of aging on hydrogen absorption during and outgassing after electrolytic charging, the effect of aging time on hardness, time to failure and fracture mode, accelerated hydrogen transport by mobile dislocations, hydrogen induced changes in fracture mode, and the effect of hydrogen on ductile fracture mechanisms. The results indicate the dependence of embrittlement on aging time in Hastelloy C-276 involves two processes. At short aging times embrittlement may be due to either P segregation or planar slip caused by short-range order. At longer times long range order is most likely responsible for embrittlement by promoting a planar slip mode. Dissert. Abstr.

N80-30476 Lehigh Univ., Bethlehem, Pa.
FRACTURE TOUGHNESS OF SOME CRYOGENIC ALLOYS Ph.D. Thesis
Bruce Robert Somers 1980 305 p
Avail: Univ. Microfilms Order No. 8019729

The elastic plastic fracture behavior of some alloys for cryogenic service was investigated using fractographic and J integral techniques. The stable crack growth initiation processes of four materials were studied: an iron 13 percent chromium 19 percent manganese austenitic alloy (Fe13Cr19Mn); an aluminum alloy with 6 percent magnesium (AMG 6); an aluminum alloy with 4.4 percent magnesium (5083); and a 99.8 percent aluminum (1180). The J integral versus crack extension, resistance curves were determined in both LT and TL orientations for Fe 13Cr19Mn, AMG 6 and 5083 at 111K and for Fe13Cr19 Mn at 76K. Compact specimens of 18 mm and 20 mm thickness were used. The J value required to initiate true crack growth, J sub IC at 111K for the 5083 LT and TL using a linear least squares R curve with 19 points averaged for each crack extension was 19.1; 16.8, 18.7, 11.3, 380, and 188 KJ square meters respectively. The J sub IC at 76K for the Fe13Cr19 LT and TL orientations using a 9 point average for each crack extension was 225 and 123 KJ/square meters respectively. At 111K the J sub IC of the 1180 aluminum was too high to be measured using a 20 mm thick specimen. Using the thickness, J levels up to 88 KJ/square meters produced only blunting.
Dissert. Abstr.

N80-30477 Delaware Univ., Newark.
HEATS OF TRANSFORMATION OF EUTECTIC ALLOYS Ph.D. Thesis
Diana Farkas 1980 256 p
Avail: Univ. Microfilms Order No. 8019916

A method to determine unknown eutectic compositions was developed, based on combined results of differential thermal analysis with metallography and microprobe analysis. A differential thermal analyzer, which gave satisfactory accuracy for qualitative measurements, was built to handle the relatively large samples that are required for this procedure. The method allowed determination of eutectic composition in no more than three steps. The heats of the resulting alloys were measured using commercial calorimeters, a differential thermal analyzer and a differential scanning calorimeter. The possibility of measuring heat capacities by differential thermal analysis was also analyzed.
Dissert. Abstr.

N80-30478 California Univ., Berkeley.
THE COMPUTER SIMULATION OF MARTENSITIC TRANSFORMATIONS IN IDEALIZED SYSTEMS Ph.D. Thesis
Sheree Hsiao-Ru Chen 1979 155 p
Avail: Univ. Microfilms Order No. 8014635

The theory of the martensite transformation was studied by constructing a computer model of martensitic transformation in an idealized system. The model had its source in the general observation that the characteristics of martensitic transformations in solids are largely determined by the problem of accommodating the strain associated with the martensitic distortion of the crystal lattice. The martensitic transformation was modeled as a transformation which occurs through the sequential formation of individual martensitic elements, each of which carries the elementary transformation strain. Statistical equations were developed which govern the selection of the transformation path, or specific sequence in which elementary martensite particles appear in the model, and which specify the kinetics of transformation along any known path. A useful representative path was defined, the minimum energy path. The resulting model was then used for the detailed simulation of a martensitic transformation in a pseudo two dimensional system. Despite the simplicity of the model virtually all interesting qualitative aspects of the developing martensitic transformation are shown to be inherently present within it. Dissert. Abstr.

N80-30479*# General Electric Co., Huntsville, Ala.
ANALYSIS AND CALCULATION OF MACROSEGREGATION IN A CASTING INGOT. MPS SOLIDIFICATION MODEL. VOLUME 1: FORMULATION AND ANALYSIS Final Report
Anna L. Maples and David R. Poirier (Arizona Univ., Tucson) Jul. 1980 54 p refs
(Contract NAS8-33573)
(NASA-CR-161540; Rept-80HV007-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 11F

The physical and numerical formulation of a model for the horizontal solidification of a binary alloy is described. It can be applied in an ingot. The major purpose of the model is to calculate macrosegregation in a casting ingot which results from flow of interdendritic liquid during solidification. The flow, driven by solidification contractions and by gravity acting on density gradients in the interdendritic liquid, was modeled as flow through a porous medium. The symbols used are defined. The physical formulation of the problem leading to a set of equations which can be used to obtain: (1) the pressure field; (2) the velocity field; (3) mass flow and (4) solute flow in the solid plus liquid zone during solidification is presented. With these established, the model calculates macrosegregation after solidification is complete. The numerical techniques used to obtain solution on a computational grid are presented. Results, evaluation of the results, and recommendations for future development of the model are given. The macrosegregation and flow field predictions for tin-lead, aluminum-copper, and tin-bismuth alloys are included as well as comparisons of some of the predictions with published predictions or with empirical data. T.M.

N80-30480*# General Electric Co., Huntsville, Ala.
ANALYSIS AND CALCULATION OF MACROSEGREGATION IN A CASTING INGOT. MPS SOLIDIFICATION MODEL. VOLUME 2: SOFTWARE DOCUMENTATION Final Report
Anna L. Maples Jul. 1980 84 p
(Contract NAS8-33573)
(NASA-CR-161541; Rept-80HV007-Vol-2) Avail: NTIS HC A05/MF A01 CSCL 11F

The software developed for the solidification model is presented. A link between the calculations and the FORTRAN code is provided, primarily in the form of global flow diagrams and data structures. A complete listing of the solidification code is given. T.M.

N80-30481*# General Electric Co., Huntsville, Ala.
ANALYSIS AND CALCULATION OF MACROSEGREGATION IN A CASTING INGOT. MPS SOLIDIFICATION MODEL. VOLUME 3: OPERATING MANUAL Final Report
Anna L. Maples Jul. 1980 48 p
(Contract NAS8-33573)
(NASA-CR-161542; Rept-80HV007-Vol-3) Avail: NTIS HC A03/MF A01 CSCL 11F

The operation of solidification model 1 is described. Model 1 calculates the macrosegregation in a rectangular ingot of a binary alloy as a result of horizontal axisymmetric bidirectional solidification. The calculation is restricted to steady-state solidification; there is no variation in final local average composition in the direction of isotherm movement. The physics of the model are given. T.M.

N80-30482*# Pratt and Whitney Aircraft Group, West Palm Beach, Fla.
EVALUATION OF THE CYCLIC BEHAVIOR OF AIRCRAFT TURBINE DISK ALLOYS, PART 2 Contractor Report, Jul.

1978 - Mar. 1980
B. A. Cowles and J. R. Warren Jul. 1980 196 p refs
(Contract NAS3-21379)
(NASA-CR-165123; PWA-FR-13153-Pt-2) Avail: NTIS HC A09/MF A01 CSCL 11F

Several nickel-base aircraft turbine disk superalloys were evaluated at 650 C for resistance to fatigue crack initiation and propagation under cyclic and cyclic/dwell conditions. Controlled strain low cycle fatigue (LCF) and controlled load crack propagation tests were performed and results utilized to provide a direct comparison among the alloys. Tests were performed on selected alloys to evaluate the effects of hold times, mean stresses, stress-dwell cycle types, inert environment, and contractor test methods. At the lower total strain ranges of interest, the alloys exhibited generally increasing initiation life with increasing tensile strength for both cyclic (0.33 Hz) and cyclic/dwell (900-sec hold per cycle) conditions. Rank order of the alloys by LCF initiation life changed substantially at higher strain ranges, approaching the rank order expected from monotonic tensile ductilities. The effect of the 900 sec (15 min) hold time fatigue life varied significantly from alloy to alloy. Generally, the higher-strength, finer-grained alloys exhibited more significant reductions in fatigue life due to the dwell. The effects of mean strain were found to be negligible and the effects of mean stress were pronounced. At high strain ranges the mean stress was near zero and did not contribute to reduction in life. At low strain ranges, however, mean stresses were large and significant reductions in LCF lives occurred. L.F.M.

N80-30483# Massachusetts Inst. of Tech., Cambridge. Dept. of and Center for Materials Science and Engineering.
MONITORING METASTABLE PHASES AND GRAIN STRUCTURES DERIVED FROM GLASSY ALLOYS Technical Report, Oct. 1978 - Jan. 1980
Kan-Sue Tan, Thomas Wahl, and Roy Kaplow 24 Mar. 1980 13 p refs Presented at Conf. on Rapidly Quenched Mater., Reston, Va., 24 Mar. 1980 Submitted for publication
(Contract N00014-76-C-0171; Grant NSF DMR-78-24185; NR Proj. 031-795)
(AD-A085882; TR-4) Avail: NTIS HC A02/MF A01 CSCL 11/2

The glassy phase affords a potentially unique route to achieving new metastable structures with desirable properties. X-ray diffraction, Mossbauer spectroscopy and electron microscopy studies of iron base alloys show a number of potentially useful (and perhaps generally characteristic) behaviors in the transition from the as-quenched glass towards equilibrium, such as relaxed glassy states, supersaturated solid solutions, unique metastable compounds and phase morphologies, and ultra-fine grain sizes. GRA

N80-30484# Massachusetts Inst. of Tech., Cambridge.
***AUSTENITIC GRAIN GROWTH CHARACTERISTICS IN* RAPIDLY SOLIDIFIED MARTENSITIC STEELS Technical Report, Oct. 1978 - Jan. 1980**
M. Suga, J. L. Goss, G. B. Olson, and J. B. VanderSande 25 Mar. 1980 10 p refs Presented at 2d Intern. Conf. on Rapid Solidification Processing Principles and Technologies, Reston, Va., *23-26 Mar. 1980* Submitted for publication
(Contract N00014-76-C-0171; NR Proj. 031-795)
(AD-A085883; TR-5) Avail: NTIS HC A02/MF A01 CSCL *11/6*

Comparison of the austenitic grain growth characteristics of conventionally processed and rapidly solidified 9Ni-4Co and 2Mo steels has revealed an unusual resistance to grain coarsening of the rapidly solidified material. At 1200 C where the conventionally processed material coarsens to a grain size of several hundred microns, the rapidly solidified material retains a grain size of approximately 20 micrometers. The morphological characteristics of the inhibited grain growth indicate strong pinning at prior powder particle boundaries. Long-time austenitizing treatments at 1100-1200 C eventually lead to discontinuous coarsening. Evidence so far suggests that the unusual coarsening resistance may be due to finely distributed sulfides. It is anticipated that high austenitizing treatment of rapidly solidified steels will allow improvement of sharp-crack fracture toughness (K sub IC) without the loss of Charpy energy and tensile ductility associated with excessive grain coarsening; exploitation of this phenomenon, however, will require an extreme level of cleanliness in powder processing. GRA

N80-30485# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
A STEM ANALYSIS OF TWO RAPIDLY SOLIDIFIED STAINLESS STEELS Technical Report, Oct. 1978 - Jan. 1980
T. F. Kelley and J. B. VanderSande 25 Mar. 1980 15 p refs Presented at 2d Conf. on Rapid Solidification Processing Principles and Technologies, Reston, Va., 23-26 Mar. 1980 Submitted for publication
(Contract N00014-76-C-0171; NR Proj. 031-795)
(AD-A085887; TR-6) Avail: NTIS HC A02/MF A01 CSCL 11/6

Scanning transmission electron microscopy (STEM) has been used for microstructural and microchemical analysis of two rapidly solidified austenitic stainless steels. One steel is a high sulfur, 303 stainless type. In this rapidly solidified steel, sulfide particles (MnS) are found to be two or three orders of magnitude smaller in size, and more uniformly distributed, than in the conventionally processed material. Extremely small sulfide particles have been observed at the cell walls and in the intracellular region of the solidification structure of individual rapidly solidified powder particles. Moreover, composition profiles have been obtained by the STEM across regular and nonregular cell walls in these powders which indicate that a high degree of chemical homogeneity was obtained. A comparison is made of the microstructures and microchemistry of individual powders, consolidated powder product, and conventionally processed versions of this high sulfur austenitic stainless steel. The rapidly solidified powders of a high phosphorus stainless steel have also been observed in STEM. The results of these observations are presented in light of the data obtained on the high sulfur steel. GRA

N80-30486# Indiana Univ. at Bloomington. Dept. of Chemistry.
THE MOLYBDENUM-MOLYBDENUM *TRIPLE* BOND. 7,1 BIS (1,3-di-p-TOLYTRIAZENIDO) TETRAKIS (DIMETHYLAMIDO) DIMOLYBDENUM
M. H. Chisholm, D. A. Haitko, J. C. Huffman, and K. Folting 9 May 1980 14 p refs
(Contract N00024-76-C-0826)
(AD-A086239; TR-80-1) Avail: NTIS HC A02/MF A01 CSCL 07/3

Mo2(NMe2)(6) reacts in hydrocarbon solvents with 1,3-di-p-tolyltriazine, C7H8NNNHC7H8, to give the title compound, Mo2(NMe2)4(C7H8N3C7H8)2, as a red, crystalline solid. An X-ray study shows that in the solid state each molybdenum atom is coordinated to four nitrogen atoms which lie in a plane; there is an unbridged molybdenum-to-molybdenum triple bond with a Mo-Mo distance of 2.212(1) angstroms, and the molecule has crystallographically imposed C2 symmetry. Variable temperature 1H nmr spectra recorded at 220 MHz support the view that this form of the molecule is present in solution. GRA

N80-30487# Naval Research Lab., Washington, D. C.
***AN ION BEAM MILLIPROBE FOR MATERIALS ANALYSIS* Final Report**
R. D. Willis and A. R. Knudson 21 Mar. 1980 26 p refs
(RR0220844)
(AD-A086109; AD-E000433; NRL-MR-4187) Avail: NTIS HC A03/MF A01 CSCL 20/7

An ion beam 'milliprobe' has recently been constructed and tested in the Materials Modification and Analysis Branch and is now being applied to the microanalysis of materials. Singly charged ion beams from the NRL 5 MV Van de Graaff accelerator with energies up to 4 MeV can be utilized. A miniature electrostatic lens in line with a pinhole aperture focuses these ion beams to spot sizes as small as approximately 20 micrometers in diameter (0.8 mil, hence the name 'milliprobe'). The sample is positioned in the millibeam by means of a motorized X-Y translation stage which allows one to conduct computer controlled two dimension scans of the sample with one micrometer steps. The milliprobe has been used in conjunction with conventional ion beam analysis techniques to characterize the near-surface regions of alloys and semiconductor materials when good lateral resolution

is a requirement. The use of the millipro be is briefly illustrated in two current studies: (1) wear reduction in stainless steels by the implantation of nitrogen and (2) surface composition changes induced by the laser annealing of silicon that has been implanted with nitrogen. GRA

NBO-30488/ University Coll. of Swansea (Wales). Dept. of Metallurgy and Materials Technology.

REVIEW OF EUROPEAN POWDER METALLURGY OF SUPERALLOYS Technology Assessment Report

R. W. Evans Dec. 1979 65 p refs Sponsored in part by AFOSR

(AD-A086682; EOARD-TR-80-10) Avail: NTIS HC A04/MF A01 CSCL 11/6

This review is an attempt to summarize the state of research and development in Europe into powder metallurgy of superalloys, and to ascertain which areas of the technology still require attention before the promised advantages of the powder metallurgy route are achieved. Although 'superalloys' are normally taken to be those alloys whose bases are nickel or cobalt, the present review deals with materials which are currently in prospect of production by powder metallurgy and which find use in the hot parts of aeroturbines. Thus it includes an account of some ferritic materials and some titanium alloys. The review deals with disc and blade alloys and discusses powder production, consolidation and the relationships between processing, structure and the final properties of powder alloys. GRA

NBO-30489/ Sussex Univ., Brighton (England). School of Engineering and Applied Sciences.

SPLAT-QUENCHING OF ZIRCONIUM ALLOYS, WITH SPECIAL REFERENCE TO MARTENSITE AND PRECIPITATE REACTIONS Technical Report, May 1978 - Apr. 1979

Srikumar Banerjee 15 Nov. 1979 58 p refs (Contract N00014-78-G-0048)

(AD-A086847; TR-3) Avail: NTIS HC A04/MF A01 CSCL 11/6

A detailed TEM study is reported of the structure of splat-quenched zirconium alloys as follows: Zr-Nb, various compositions; Zr-27at% Al; Zr-14at% Ni; Zr-24at% Fe. The details of martensite and omega morphology in Zr-Nb, spinodal and precipitation reactions in Zr-Al, and the crystallisation of the amorphous phase in Zr-Ni and Zr-Fe are all fully described. In Zr-FE, a novel morphology is described: a circular core of beta surrounded by six twin-related 'petals' of alpha, forms a 'sunflower' pattern not hitherto reported. GRA

NBO-30490/ Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.

PLASTIC FLOW AND FRACTURE PROCESSES IN POWDER METALLURGICAL NICKEL-BASE SUPERALLOYS Final Report, 1 Mar. 1977 - 29 Feb. 1980

C. C. Law and M. J. Blackburn Feb. 1980 134 p refs (Contract F49620-77-C-0083; AF Proj. 2306)

(AD-A086697; PWA-FR-13317; AFOSR-80-0468TR) Avail: NTIS HC A07/MF A01 CSCL 11/6

The advent of powder metallurgical methods for nickel-base superalloys has made it possible to use high-strength alloys for large components such as turbine disks. Although much of the manufacturing and process technology for such products is reasonably well understood, many of the features of the structure-property relationships in these alloys remain unclear. This document describes the results of a three-year effort undertaken to provide insight into the factors that control specific properties in advanced powder metallurgical nickel-base superalloys. The first-year effort examined the stress-rupture characteristics of smooth sections of a number of alloys including AF115 and MERL 76. It was concluded that the ability of a material to store dislocations controls the creep rate but that the fracture processes were dictated by grain boundary structures. Models that satisfactorily accounted for the behavior pattern were developed. The second-year effort extended the study to notch-rupture properties which were found to depend upon a larger number of variables. An interesting parallel between short notch lives and the fracture times of smooth sections tested under stress relaxation was found. Based on this observation, certain mechanical critieria for poor notch characteristics could be identified. GRA

NBO-30491/ Naval Research Lab., Washington, D. C. Surface Chemistry, Branch.

STUDIES ON CORROSION PREVENTION OF MARDAN CONNECTORS BY ORGANIC COATINGS Final Report, May 1977 - Sep. 1979

B. J. Kinzig and J. S. Murday 9 Jun. 1980 36 p refs

(AD-A086730; AD-E000464; NRBL-MR-4230) Avail: NTIS HC A03/MF A01 CSCL 11/3

Electrical disturbances caused by the formation of corrosion products on computer contacts is a serious problem, especially in older contacts containing a tarnish-prone silver layer under gold plating. The efficacy of a number of corrosion preventative organic fluids in preventing corrosion in sulfide-bearing atmospheres has been evaluated, in conjunction with a chromating process for the same purpose. Studies were made both with connectors and with silver. A statistical treatment applied to visual evalustion clearly identified two organic formulations as effective corrosion inhibitors, verifying other observations. These fluids were as effective as chromating alone, but an additional measure of protection was afforded by the combination of chromate/organic fluid. GRA

NBO-30492/ Naval Postgraduate School, Monterey, Calif. Dept. of Mechanical Engineering.

THE INFLUENCE OF PRIOR WARM ROLLING ON FRACTURE TOUGHNESS OF HEAT TREATED AISI 52100 STEEL M.S. Thesis

Jeffrey F. McCauley Mar. 1980 83 p refs

(AD-A086821) Avail: NTIS HC A05/MF A01 CSCL 11/6

An investigation was conducted to determine the effects of prior warm rolling on AISI 52100 bearing steel in the hardened condition. Microstructural and mechanical properties of both standard and warm rolled 52100 were investigated. Heat treatments, consisting of both conventional hardening treatments and isothermal transformation treatments, were conducted prior to fracture toughness, hardness, and tensile testing. Conventional hardening treatments resulted in martensitic structures with low toughness; prior warm rolling resulted in the rolled materials exhibiting both higher hardness and toughness than the standard 52100 in the hardened condition. Isothermal transformation treatments resulted in substantially improved toughness, especially in the material processed at 300 C. GRA

NBO-30493/ National Bureau of Standards, Washington, D.C. National Measurement Lab.

STUDIES OF MICROSCOPIC ASPECTS OF WEAR PROCESSES IN METALS Annual Report, 1 Apr. - 31 Dec. 1979

A. W. Ruff and J. P. Blau Jun. 1980 79 p refs (Contract N00014-79-F-0034)

(AD-A086760; NBSIR-80-2058) Avail: NTIS HC A05/MF A01 CSCL 11/6

Wear experiments have been conducted in copper alloys and steels under dry sliding conditions in order to study the microscopic aspects of wear and the mechanisms involved. Two experimental wear test systems have been developed, a linear sliding tester and a block-on-ring computer controlled tester. Preliminary findings have compared the wear rates of three different steels, one a high strength-low alloy 'dual phase' steel, and two copper-aluminum alloys. Worn surface and subsurface morphologies have been studied using optical and scanning electron microscopy. Wear debris particles have been recovered from the tests and compared in morphological characteristics between the materials. Mechanical properties measurements of two of the steels were carried out to determine strain hardening characteristics for comparison with wear behavior. Micro-hardness measurements have also been made. Initial wear rate and friction transients for tests in laboratory air and argon have been examined to study processes involved in the early stages of sliding. GRA

NBO-30494/ Imperial Coll. of Science and Technology, London (England).

THE ROLE OF HYDROGEN IN THE STRESS CORROSION FAILURE OF HIGH STRENGTH Al-Zn-Mg ALLOYS AND SENSITIZED AUSTENITIC STAINLESS STEELS Final Annual Technical Report

L. Christodoulou, M. G. Lackey, H. M. Flower, F. J. Humphreys, and P. R. Swann Apr. 1980 39 p refs

(Grant DA-ERO-77-G-011; DA Proj. 1T1-61102-BH-57)
(AD-A086427) Avail: NTIS HC A03/MF A01 CSCL 11/6

An investigation into the effect of exposure of Al-Zn-Mg alloys to water vapor has shown that hydrogen, produced by the reaction is absorbed by both the alloy grain boundaries and matrix. The amount of absorbed hydrogen depends on the local chemistry and the metal/oxide interface and is influenced by alloying additions. Attainment of a critical concentration of dissolved hydrogen in the boundaries leads to brittle intergranular fracture on the subsequent application of stress. Attainment of a critical hydrogen concentration in the matrix leads to transgranular cleavage fracture. Depending upon the alloy composition and heat treatment bubbles of gaseous hydrogen can be formed at suitable sites within the alloys such as grain boundary particles. The formation of grain boundary bubbles reduces embrittlement by reducing the local concentration of dissolved hydrogen. It is proposed that the interaction of stress and environmental variables with the above criteria governs the environmental failure of Al-Zn-Mg alloys in aqueous and water vapor containing environments. It is suggested that such failures are hydrogen embrittlement dominated. GRA

N80-30495# Electronics Research Lab., Adelaide (Australia).
THE FLASH EVAPORATION OF POWDERED INDIUM ANTIMONIDE
R. H. Hartley Jan. 1980 20 p refs
(AD-A086531; ERL-0103-TR; AR-001-904) Avail: NTIS HC A02/MF A01 CSCL 11/6

It has been shown experimentally for deposition rates of practical interest, that the flash evaporation of powdered indium antimonide from a black body source yields a stoichiometric vapor over a wide angular range about the axis of the source. Films deposited by this means have an excellent surface finish and are free from the surface defects often associated with flash evaporation employing other source geometries. GRA

N80-30496# California Univ., Berkeley. Dept. of Materials Science and Mineral Engineering.
MODIFIED 43XX STEELS FOR HIGH TOUGHNESS **Final Report, 27 Sep. 1977 - 31 Mar. 1980**
Naresh J. Kar, V. F. Zackay, and E. R. Parker Apr. 1980 70 p refs
(Contract DAAG46-78-C-0036; DA Proj. 1L1-61102-AH-42)
(AD-A086453; AMMRC-TR-80-20) Avail: NTIS HC A04/MF A01 CSCL 11/6

Isothermal transformations were carried out in the vicinity of M sub s temperatures on Si, Al: Si modified AISI 4330, 4340 steels, which had been remelted by electroslag refining (ESR) techniques. The microstructures of the heat-treated variants were characterized by transmission electron microscopy. Mechanical property evaluations (Charpy impact energies, tensile strengths, plane-strain fracture toughness data) of the different microstructures were also carried out. Isothermal transformations in these steels resulted in bainite, bainite: martensite microstructures, containing moderate amounts of retained austenite. The austenite was found to be in the form of thin films around the bainite, martensite laths. The strength-toughness combinations obtained in this investigation for Si-modified AISI 4330 steel appear to be superior to those for unmodified AISI 4340 and 300- M steels, whilst the strength-toughness combinations obtained for Al: Si modified AISI 4340 steel appear to be comparable to those for 18 Ni Co Mo maraging steel. The merits of ESR-processing these steels are also reflected in the uniform Charpy impact properties obtained for the different orientations investigated. GRA

N80-30497# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio. Mechanics and Surface Interactions Branch.
AN INVESTIGATION OF A COMPOSITE OXIDE FILM AS A CORROSION INHIBITOR FOR 2024 ALUMINUM **Interim Report, Jan. - Dec. 1979**
Neil T. McDevitt and Frank N. Weaver (Morris Brown Univ.) Jun. 1980 38 p refs
(AF Proj. 2419)
(AD-A086791; AFWAL-TR-80-4065) Avail: NTIS HC A03/MF A01 CSCL 11/4

This study shows the corrosion resistance of the oxide film on 2024 aluminum can be improved over the neat anodic oxide by forming a composite oxide film using as a sequential process a chromate conversion solution dip followed by phosphoric acid anodization. GRA

N80-30498# Aeronautical Research Labs., Melbourne (Australia).
SCATTER OF FATIGUE CRACK RATES IN 7XXX ALUMINUM ALLOYS
D. G. Ford Mar. 1980 17 p refs
(AD-A086543; ARL/Struc-TM-309) Avail: NTIS HC A02/MF A01 CSCL 11/6

Thirty-three crack growth curves were analysed in order to estimate the logarithmic variance of fatigue crack growth rate for several 7XXX Aluminum Alloys in various conditions. The estimated standard deviation common to all of these was s = 0.1241 with 18 degrees of freedom. It was concluded that this estimate holds for differing types of 7XXX aluminium alloys, constant amplitude and block programme loading. The errors it summarises include effects of microstructure, heat treatment and purity not described by the alloy specification. R.C.T.

N80-30499# Southern Univ., Baton Rouge, La. Dept. of Mechanical Engineering.
AN INVESTIGATION OF MECHANISMS EFFECTING ENVIRONMENTAL STRESS CRACKING IN TITANIUM ALLOY
Ira J. Graham 3 Apr. 1980 31 p refs
(Contract N00019-79-C-0137)
(AD-A086979) Avail: NTIS HC A03/MF A01 CSCL 11/6

The acoustic emission technique was applied to monitor visible crack growth and microcrack formations as energy release in real time in titanium alloy using a 12.8 mm (0.510 in) WOL compact specimen in a plane strain mode. The specimens were fatigued in the 30 - 60 Hz range at a determined stress intensity factor (K sub I) with an acoustic emission transducer at a gain of 85 dB and a bandpass frequency of 0.1 - 0.3 MHz. A stable crack advanced and microcracks formed at angles other than parallel to the advancing stable crack as intermittent energy bursts in or along the boundaries of the grains. The energy release, referred to as 'acoustic emission', is a kind of elastic stress impulse. Crack movement in the order of magnitude million in/cyl were detected. Determination was made of the subcritical stress intensity factor (K sub sc) where the amplitude of the fatigue cycles no longer provide the energy source large enough to cause the crack to advance. GRA

N80-30500# Michigan Technological Univ., Houghton. Dept. of Metallurgical Engineering.
DEFORMATION OF AN ALLOY WITH A LAMELLAR MICROSTRUCTURE: EXPERIMENTAL
K. S. Chan, C. C. Wojcik, and D. A. Koss May 1980 34 p refs
(Contract N00014-76-C-0037; Grant AF-AFOSR-2596-74)
(AD-A087100; TR-12) Avail: NTIS HC A03/MF A01 CSCL 11/6

The deformation behavior of individual Widmanstatten colonies comprised of aligned lamellae of ductile phases has been investigated. Based on the alpha-beta Ti alloy, Ti-8Al-1Mo-1V, this study shows the existence of a large 2 X variation in the critical resolved shear stress for yielding of individual colonies. Schmid's Law is not obeyed except for prism slip parallel to the beta lamellae. In addition, colonies with a high yield stress exhibit a high work hardening rate and fine, uniform slip, while colonies with a low yield stress deform by planar, non-uniform slip. This behavior appears to be independent of slip system basal, prism, or pyramidal and of microstructure alpha-beta vs. alpha-alpha: martensite. The experimental behavior is correlated to several colony orientation parameters including the stress axis, slip plane, slip direction, and orientation of the alpha-beta interface. The yield stress of a colony is found to increase as the slip direction of the dominant macroscopic slip plane tends toward being normal to the alpha-beta interface. These results indicate that the macroscopic flow behavior of colonies comprised of ductile lamellae depends on the ability of a slip system, once activated in the softer phase, to shear through the harder phase. The data also indicates that the interaction stresses at the phase interfaces are not a principal factor controlling macroscopic yielding. Finally, the alignment of a slip system in the alpha-phase

with a potential slip system in the beta-phase lamellae does not appear to affect the yield stress strongly. GRA

N80-30501# Dartmouth Coll., Hanover, N.H. Dept. of Physics and Astronomy.

EXPERIMENTAL DETERMINATION OF THE TEMPERATURE DEPENDENCE OF METALLIC WORK FUNCTIONS AT LOW TEMPERATURES Final Report

P. Bruce Pipes Mar. 1980 6 p refs

(Contracts EY-76-S-02-2314; DE-AS02-76ER-02314)

(DOE/ER-02314) Avail: NTIS HC A02/MF A01

Work involving the use of a modified Kelvin technique to study the temperature dependence of the work function of both bare metallic surfaces and metallic surfaces with He-4 gas adsorbed onto them is described. DOE

N80-30502# Bendix Corp., Kansas City, Mo.

PULSE PLATING OF NICKEL DEPOSITS

C. J. Stimetz and M. F. Stevenson Feb. 1980 17 p refs

Presented at 67th Ann. AES Tech. Conf., Milwaukee, 22-26 Jun. 1980

(Contract EY-76-C-04-0613; DE-AC04-76DP-00613)

(BDX-613-2378; CONF-800621-1) Avail: NTIS HC A02/MF A01

Pulse plated and conventional nickel deposits were compared for differences in morphology, mechanical properties, and microstructure. The deposits were obtained from nickel sulfamate, nickel chloride, and Watts nickel plating solutions. No significant difference were found in the direct and pulse current deposits from the sulfamate and chloride solutions; however, significant differences in microstructures, yield strength, and microhardness were observed in deposits from the Watts nickel solution. DOE

N80-30503# Sandia Labs., Albuquerque, N. Mex.

METALLOGRAPHIC PREPARATION OF TITANIUM DIBORIDE COATINGS

Mark E. McAllaster Mar. 1980 12 p

(Contracts EY-76-C-04-0789; DE-AC04-76DP-00789)

(SAND-80-0596) Avail: NTIS HC A02/MF A01

A method is described for preparing metallographic cross sections of thin, hard, chemically vapor deposited titanium diboride coatings on various softer substrates. Standard metallographic preparation techniques were found to result in fracturing and edge rounding of the coatings. It is shown that these problems can be avoided by unidirectional grinding on worn 600 grit silicon carbide abrasive paper. Typical photomicrographs of chemically vapor deposited titanium diboride coatings are shown along with photomicrographs of intermediate phases that form at the titanium diboride substrate interfaces. DOE

N80-30504# California Univ., Livermore. Lawrence Livermore Lab.

VISCOSITY OF METALS IN EXPLOSIVE WELDING

I. D. Zakharenko and V. I. Mali Nov. 1979 9 p refs Transl. into ENGLISH of the book "Gorenie i Vzryv, Materialy Tretego Vsesoyuznogo Simpoziuma go Goreniyu i Vzryvu" Moscow, Nauka Press, 1972 p 575-578 Conf. held in Moscow, 5-10 Jul. 1971

(UCRL-Trans-11542) Avail: NTIS HC A02/MF A01

A mathematical analysis of explosive welding is given of metal plates. DOE

N80-30505# Sandia Labs., Albuquerque, N. Mex.

HYDROSTATIC STRESS DEPENDENT YIELD OF 7075-T6 ALUMINUM

Steve E. Benzley, Tom G. Priddy, and Mark S. SooHoo Mar. 1980 21 p refs

(Contracts EY-76-C-04-0789; DE-AC04-76DP-00789)

(SAND-79-2220) Avail: NTIS HC A02/MF A01

Tension and compression tests on notched cylindrical bars made of 7075-T6 aluminum, conducted as a part of an investigation of the mechanics of ductile fracture, are discussed. The compression tests showed significantly stiffer behavior in the nonlinear portion of the experiment than those found from the tension tests. This difference was accounted for by incorporating a hydrostatic stress dependent yield model in the analysis of the experiment. The model was verified by comparing finite element calculations with the actual experimental results. DOE

N80-30508# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.

WELDABILITY OF THERMALLY GRAIN-REFINED Fe12Ni-0.25Ti FOR CRYOGENIC STRUCTURAL APPLICATIONS M.S. Thesis

Douglas Edwards Williams Feb. 1980 43 p refs

(LBL-10259) Avail: NTIS HC A03/MF A01

The weldability of a research alloy designed for structural use in liquid helium temperature, cryogenic environments is investigated. Plates of iron 12 weight percent nickel 0.25 weight percent titanium were grain refined by the four step, grain refining thermal treatment developed for this alloy and welded with Inconel Number 92 weld wire using the gas metal arc welding process with argon 15% helium gas shielding. Both a single pass and a double sided, two pass electron beam weld were also made without filler metal addition. Weldments were radiographed and sectioned and the charpy V notch specimens removed were tested at liquid nitrogen and helium temperatures. DOE

N80-30507# Pennsylvania State Univ., University Park. Metallurgy and Physics Depts.

HYDROGEN ABSORPTION IN METALS: A FIELD ION MICROSCOPY STUDY Progress Report, 1 Jun. 1979 - 31 May 1980

T. Sakurai and H. W. Pickering Feb. 1980 9 p refs

(Contract DE-AC02-79ER-10430)

(DOE/ER-10430) Avail: NTIS HC A02/MF A01

Progress is summarized in sample preparation, computer interfacing for automated data acquisition, and computer simulation of ion optics of atom probes, in addition to the actual chemical compositional analysis of the Fe-Ti alloy samples and observations on hydrogen induced microcracking. It is found that Ti segregates at the surface and grain boundaries when heated to and above 800 C. Some of the Ti atoms form clusters with carbon, nitrogen, and oxygen as a nucleus. The formation and propagation of a microcrack involving hydrogen was documented on a truly atomic scale. DOE

N80-30508# California Univ., Berkeley. Lawrence Berkeley Lab. Dept. of Materials Science and Engineering.

CONSEQUENCES OF THE RE-TRANSFORMATION OF PRECIPITATED AUSTENITE IN FERRITIC CRYOGENIC STEELS

J. W. Morris, Jr., C. K. Syn, J. I. Kim, and B. Fultz Jun. 1979 12 p refs Presented at the Intern. Conf. on Martensitic Transformation, Boston, 24 Jun. 1979

(Contract W-7405-eng-48; N00014-75-C-0154)

(LBL-10128; TN-8; CONF-7906103-4) Avail: NTIS HC A02/MF A01

The retransformation of precipitated austenite (gamma/sub R/) in Fe-(6-9)%Ni steels is investigated, with particular emphasis on the influence of transformation characteristics on alloy toughness at cryogenic temperature. In all cases studied the precipitated austenite retransforms, either during cooling to cryogenic temperature or during deformation prior to fracture of the alloy. When the retransformation is thermally induced the product martensite tends to form in a variant identical to that present before precipitation of the austenite, no significant refinement of the microstructure is achieved. On the other hand, mechanical transformation of the austenite produces a distribution of martensite variants determined by the local strain, hence preserving a refined microstructure conducive to low temperature toughness. DOE

N80-30509# Brown Univ., Providence, R. I. Div. of Engineering.

EFFECT OF ALLOY DEFORMATION ON THE AVERAGE SPACING PARAMETERS OF NON-DEFORMING PARTICLES

J. Fisher and J. Gurland Feb. 1980 16 p refs Submitted for publication

(Contract DE-AC02-80ER-10555)

(COO-3084-75; TR-75) Avail: NTIS HC A02/MF A01

It is shown on the basis of stereological definitions and a few simple experiments that the commonly used average dispersion parameters, are a fraction (alpha/sub alpha/)/sub beta/, areal particle density N/ sub alpha beta/ and mean free path lambda/sub alpha/, remain invariant during plastic deformation

in the case of non-deforming equiaxed particles. Directional effects on the spacing parameters N/sub alpha beta/ and lambda/sub alpha/arise during uniaxial deformation by rotation and preferred orientation of nonequiaxed particles. Particle arrangement in stringered or layered structures and the effect of deformation on nearest neighbor distances of particles and voids are discussed in relation to strength and fracture theories. DOE

N80-30510# Brown Univ., Providence, R. I. Engineering Div.
VOID NUCLEATION IN SPHEROIDIZED STEELS DURING TENSILE DEFORMATION
John Robb Fisher, Jr. Apr. 1980 193 p refs
(Contracts EY-76-S-02-3084; E(11-1)-3084)
(COO-3084-77) Avail: NTIS HC A09/MF A01

The effects of various mechanical and material parameters on void formation at cementite particles in axisymmetric tensile specimens of spheroidized plain carbon steels are investigated. Desired microstructures for each of three steel types were obtained. Observations of void morphology with respect to various microstructural features were made using optical and scanning electron microscopy. DOE

N80-30511# Mound Lab., Miamisburg, Ohio.
NICKEL-IRON ALLOY CORROSION IN A SEALED PYROTECHNIC SYSTEM
Elton E. Tibbitts and Robert F. Salerno 1980 23 p refs
Presented at the 7th Intern. Pyrotechs. Seminar, Vail, Colo., 14 Jul. 1980
(Contract DE-AC04-76DP-00053)
(MLM-2707(OP)); CONF-800713-2) Avail: NTIS HC A02/MF A01

Actuators loaded with Ti/KClO4 and aged for several days had chlorine containing corrosion products on Alloy-52 electrode pins and Tophet-C bridgewire surfaces. An in depth analysis of these materials indicated that moisture, organic contamination, and chlorine were the major causes of the corrosion. Definite evidence was uncovered that indicated a partial decomposition of the KClO4 was the major source of the chlorine. In the presence of moisture, particles that settle on the metal surface cause the formation of galvanic or oxygen concentration cells that dissolve to produce electrolytes on the metal surface causing corrosion of the metal. It is shown that corrosion can be eliminated by reducing the humidity to below a critical level and vacuum drying the pyrotechnic so that no moisture is considered on the metal. Since water is consumed in the reaction forming hydrated oxides or hydroxides, the extent of the reaction is limited by the amount of water in the sealed unit. DOE

N80-30512# Standard Pressed Steel Labs., Naas (Ireland). Space Lab.
EVALUATION OF TITANIUM BOLTS COATED WITH IVADIZE ALUMINUM AND KALGARD 2240 C IN TORQUE TENSION TESTS
J. Newnham, B. Hassell, and P. Behan Nov. 1979 68 p refs
(Contract ESTEC-3698/78-NL-PP(SC))
(SPS-5254; ESA-CR(P)-1304) Avail: NTIS HC A04/MF A01

Proprietary aluminum coatings were evaluated in torque tension tests on titanium alloy nuts and bolts. The objective was to identify a coating/lubricant combination for titanium alloy fasteners, which would give consistent frictional conditions on repeated installations, provide corrosion resistance in marine environments, and be compatible with space conditions. The coatings evaluated were the McDonnell 'Ivadize' coating, and Kalgard 2240 C paint coating. Both were tested in the unlubricated condition, and lubricated either with an oil or a bonded molybdenum disulphide coating. Ivadize coated fasterners did not allow more than about five applications even with the best lubricant. Kalgard coatings allowed the full twenty five installations without excessive increase in friction, when molybdenum disulphide was used as lubricant. Author (ESA)

N80-30513# National Bureau of Standards, Washington, D.C. Corrosion and Electrodeposition Group.
MEASURING THE RATE OF CORROSION OF REINFORCING STEEL IN CONCRETE Annual Report
E. Escalante, S. Ito, and M. Cohen Mar. 1980 45 p refs
Sponsored in part by Federal Highway Administration Washington, D.C.
(PB80-170848; NBSIR-80-2012) Avail: NTIS HC A03/MF A01 CSCL 13C

Progress in developing a nondestructive method for measuring the corrosion of steel in concrete as related to bridge deck deterioration is reported. Several polarization techniques for measuring the corrosion rate of steel in concrete are correlated to actual weight loss measured gravimetrically. The design of a prototype automated minicomputer system for measuring the corrosion of steel in concrete is also described. Laboratory results on the effect of pH, Cl-, O sub 2, and moisture on initiating and maintaining corrosion in mortar are included. GRA

N80-30514# National Materials Advisory Board, Washington, D. C.
SUPPLY AND USE PATTERNS FOR THE PLATINUM-GROUP METALS Final Report
1980 220 p refs Sponsored in part by Dept. of Commerce and Bureau of Mines
(Contract GS-00-DS-(P)-94008)
(PB80-179088; NMAB-359) Avail: NTIS HC A10/MF A01 CSCL 11F

A survey of background information on the chemistry, geology, and supply sources and a detailed evaluation of current and future usage for all six platinum group metals are presented. The extensive use of platinum, palladium, and later, rhodium in automotive emission control systems is projected to continue for some time. Recycling of spent or discarded catalytic converters is advised as an important source of the platinum group metals they contain, but the current (1978) economic picture appears to make the activity marginal at best. The content of the National Stockpile is reviewed and the need to increase the amounts and to upgrade the forms to existing specifications is shown. In addition, it is recommended that rhodium be added to the stockpile list as a critical and strategic material. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N80-30515 Pennsylvania Univ., Philadelphia.
CHARACTERIZATION OF MACROMOLECULAR FILMS ADSORBED IN TRACK-ETCHED MEMBRANES Ph.D. Thesis
Gregory Lawrence Powers 1980 208 p
Avail: Univ. Microfilms Order No. 8018600

A method was developed for determining the thicknesses of adsorbed macromolecular layers in porous membranes. Bovine serum albumin (BSA) was chosen as the solute macromolecule owing to its uniformity, stability, and size. The porous membranes were of muscovite mica with pores formed by the track etch process. The thickness of the (tightly bound) layer was determined by measuring electrolyte conductance (KCl) through the pores in the presence and absence of BSA. Electrolyte conduction was also employed to provide an accurate assessment of molecular partitioning in the pores. The partitioning measurement gave information on the total amount of BSA in the pores, both that bound as a wall layer as well as additional protein in solution within the pore. Membranes were made from sheets of muscovite mica 7 micron thick. Damage tracks were formed by irradiation with a collimated beam of massive fission fragments emitted from a Cf252 source. The damage tracks produced were etched into discreet pores with hydroflouric acid. Dissert. Abstr.

N80-30516 Iowa State Univ. of Science and Technology, Ames.
FATIGUE EFFECTS IN THE WEAR OF POLYMERS Ph.D. Thesis
Vinod Kumar Jain 1980 184 p
Avail: Univ. Microfilms Order No. 8019638

A wear equation was developed using the concept of repetitive loading of asperities on the mating surfaces in a sliding situation. It postulates elastic deformation in the contact zone and asperities with spherical tips. The wear equation is epxressed in terms of the sliding parameters, surface topographical parameters, modulus of elasticity, and fatigue properties of the

weaker material. The equation is consistent with experimental data for the case of poly(methyl methacrylate), poly(vinyl chloride) and high density polyethylene pins sliding against a steel disk. Scanning electron microscopy revealed that the worn surfaces of poly(methyl methacrylate) and high density polyethylene pins were covered with arced ripples stretching across the transverse direction. In the case of poly(vinyl chloride) there were signs of considerable plastic deformation on the worn surface. The fracture surfaces of notched fatigue samples of poly(methyl methacrylate) exhibited well-defined striation markings which were obscure, ill-defined and discontinuous in the case of high density polyethylene and poly(vinylchloride). The final stage of fatigue fracture in the latter two materials was accompanied with plastic deformation. Dissert. Abstr.

N80-30517# Naples Univ. (Italy). Dept. of Chemical Engineering.

EFFECT OF APPLIED STRESS, THERMAL ENVIRONMENT AND WATER IN EPOXY RESINS Interim Scientific Report, 1 Jul. 1978 - 30 Nov. 1979

L. Nicolais, E. Drioli, and A. Apicella Nov. 1979 54 p refs Prepared for European Office of Aerospace Research and Development, London

(Grant AF-AFOSR-3369-77; AF Proj. 2307)

(AD-A086200; AFOSR-80-0474TR) Avail: NTIS HC A04/MF A01 CSCL 11/4

Because of their elevated physical properties, epoxy resins are widely used as matrices for high performance composites. However, due to moisture induced plasticization and formation of microcavities, high temperature and humidity tend to reduce their physical properties. A history dependent solubility model is generalized in accordance with the Dual Mode Sorption theory to account for effective water diffusion coefficients based on microcavitational damage brought about by temperature and moisture. Laboratory testing for weight changes in sorption-description experiments have been accomplished using a McBain quartz-spring microbalance placed in a temperature and humidity controlled cell. Equilibrium moisture absorption levels were represented both by linear and upward isotherms depending upon the humidity history. Analysis of sorption data, using a transport model in which part of the diffusing molecules are completely immobilized in the formed microcavities, revealed the damaging process to be in agreement with the diffusion coefficient depressions and solubility increases predicted by the model. A crazing criterion is qualitatively used to test the nature of the damaging process. GRA

N80-30518# Massachusetts Univ., Amherst. Dept. of Polymer Science and Engineering.

EFFECT OF STRUCTURE ON PHYSICAL PROPERTIES OF POLYMERS Final Report, 1 Jan. 1976 - 31 Dec. 1979

Frank E. Karasz 31 Dec. 1979 22 p refs

(Grant AF-AFOSR-2983-76; AF Proj. 2303)

(AD-A086199; AFOSR-80-0475TR) Avail: NTIS HC A02/MF A01 CSCL 11/9

The overall objective of this research program has been to investigate the physical nature of macromolecular systems as a function of the chemical and stereochemical structure of the macromolecule. A potential improvement in important facets of polymer properties was an underlying premise in the design and execution of the research. The work performed included investigations of the behavior of polymers in solution, as well as in the solid state and was accompanied by a program of theoretical studies to complement the experimental work. One focus of the research was the area of polymer-polymer interactions in binary blends, in which factors influencing compatibility, i.e., mutual solubility, were systematically investigated by a number of thermodynamic techniques. Heats of polymer mixing were obtained for selected systems and shown to be useful in predicting phase behavior otherwise obscured by non equilibrium effects. The latter were also investigated theoretically in studies of the effect of domain size and composition on glass transition temperatures and allied phenomena. Another area of research concerned the physical properties of model epoxy network systems, and in particular, the effect of water on these properties. A characteristic of cross linked polymers is their ready plasticization by relatively small amounts of low molecular weight materials and the basis of this observation has been explained on a thermodynamic basis. Solution properties of polymers were studied by means of quasi-elastic light scattering. GRA

N80-30519# Dow Corning Corp., Midland, Mich. Advanced Research Lab.

CYCLIC FLUOROSILICONE POLYMERS AND COPOLYMERS Final Report, 1 Jan. 1977 - 31 Jan. 1980

O. R. Pierce and K. M. Lee 1980 39 p

(Contract F49620-77-C-0012; AF Proj. 2303)

(AD-A086748; AFOSR-80-0489TR) Avail: NTIS HC A03/MF A01 CSCL 11/9

Several reactions were examined as potential routes to reactive cyclic tetrasiloxanes and their precursors. The reactions examined in some detail were cohydrolysis, siloxy-chloride exhange, hydrolysis of triple bond SiCl, triple bond SiOMe and triple bond SiH and acetoxy-silanol condensations. Using these reactions several intermediates were prepared and the new compounds were characterized. GRA

N80-30520# Air Force Materials Lab., Wright-Patterson AFB, Ohio.

MODEL COMPOUND STUDIES OF RIGID ROD AROMATIC HETEROCYCLIC POLYMER SYSTEMS. PART 1: THE CRYSTAL AND MOLECULAR STRUCTURES OF 2,6-DIPHENYLBENZL (1,2-D:4,5-D') BISTHIAZOLE AND 2,6-DIPHENYLBENZO (1,2-D:5,4-D') BISOXAZOLE Final Report, Apr. 1977 - Apr. 1978

M. W. Wellman, W. W. Adams, D. R. Wiff, and A. V. Fratini Feb. 1980 28 p refs

(AF Proj. 2303)

(AD-A086804; AFML-TR-79-4184-Pt-1) Avail: NTIS HC A03/MF A01 CSCL 11/9

The X-ray crystal structures of two monomeric model compounds for polybisbenzoxazole (PBO) and polybisbenzthiazole (PBT) are presented. The PBO model compound molecules stack along the b crystallographic axis in two vertical columns of differing orientation and are inclined to b by an angle of 36 deg. The repeat distance along b is 5.94A and the perpendicular distance between adjacent molecules in a particular stack is 3.4A. The PBT model compound molecules stack most efficiently along its b crystallographic axis with an inclination angle of 36.8 deg. Adjacent molecules along c exhibit a crossing pattern with a dihedral angle of 73.6 deg. The relationship between the model compound structures and the gross packing features of polymer chains in PBO and PBT are discussed. GRA

N80-30521# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.

TRIAXIALLY WOVEN FABRICS OF KEVLAR, DACRON POLYESTER AND HYBRIDS OF KEVLAR AND DACRON POLYESTER Final Report

Eleanor Th. Vadala 3 Apr. 1980 20 p refs

(WF414110001)

(AD-A086866; NADC-80020-60) Avail: NTIS HC A02/MF A01 CSCL 11/9

To provide data for possible LTA (Lighter Than Air) application, four triaxially woven fabrics were made using yarns of: (1) Kevlar aramid, (2) Dacron polyester and (3) hybrids of aramid and polyester. The woven triaxial fabrics were coated with urethane. The material samples were characterized by removal and test of specimens. The test matrix included creasing and environmental conditioning tests. GRA

N80-30522# Pennsylvania Univ., Philadelphia. Dept. of Chemistry.

ORGANIC METALS AND SEMICONDUCTORS: THE CHEMISTRY OF POLYACETYLENE, (CH) SUB X, AND ITS DERIVATIVES Interim Report

Alan G. MacDiarmid and Alan J. Heeger 24 Nov. 1979 13 p refs Presented at the 3d Intern. Congr. of Quantum Chem., Kyoto, Oct. 1979

(Contract N00014-75-C-0962; NR Proj. 356-602)

(AD-A086870; TR-79-11) Avail: NTIS HC A02/MF A01 CSCL 20/12

Polyacetylene, (CH)x, is the simplest possible conjugated organic polymer and is therefore of special fundamental interest. In a series of studies, Shirakawa and Ikeda have shown that it can be prepared in the form of lustrous, silvery, flexible,

polycrystalline films having any desired cis/trans content by catalytic polymerization of gaseous acetylene, C2H2. The cis-rich films can be stretched easily at room temperature in excess of three times their original length with concomitant partial alignment of the (CH)x fibrils. Dark red gels of toluene in (CH)x may be prepared using a lower catalyst concentration. Highly porous, very low density, 'foam-like' (CH)x can be obtained from these gels. Both cis- and trans-(CH)x are p type semiconductors which can be treated with a variety of p or n type dopants with concomitant increase in conductivity to give a series of semiconductors and ultimately, 'organic metals'. This report will be directed primarily towards a description of the more chemically oriented aspects of (CH)x and its derivatives. GRA

N80-30523# Pennsylvania Univ., Philadelphia. Lab. for Research on the Structure of Matter.

CONDUCTING ORGANIC POLYMERS: DOPED POLYACETYLENE Interim Technical Report

Alan J. Heeger and Alan G. MacDiarmid 24 Nov. 1979 45 p refs Presented at the Advanced Study Inst. on the Phys. and Chem. of Low Dimensional Solids, Tomar, Portugal, Aug. 1979 (Contract N00014-75-C-0962; NR Proj. 356-602)

(AD-A086869; TR-79-10) Avail: NTIS HC A03/MF A01 CSCL 11/9

Linear polyacetylene, (CH)x is the simplest conjugated organic polymer and is therefore of special fundamental interest. Interest in this semiconducting polymer has been stimulated by the successful demonstration of doping with associated control of electrical properties over a wide range; the electrical conductivity of films of (CH)x can be varied over 12 orders of magnitude from that of an insulator (sigma approximately equal to ten to the minus 9th power/ohm/cm) through semiconductor to a metal (sigma approximately equal to ten to the minus 13th power/ohm/cm). Various electron donating or accepting molecules can be used to yield n-type or p-type material, and compensation and junction formation have been demonstrated. GRA

N80-30524# Northwestern Univ., Evanston, Ill. Dept. of Materials Science and Engineering.

FRACTURE STUDIES OF HIGH TEMPERATURE CERAMICS Final Report, 1 Oct. 1975 - 30 Sep. 1979

D. Lynn Johnson May 1980 67 p refs

(Grants AF-AFOSR-2920-76; NSF DMR-76-80847; AF Proj. 2306)

(AD-A086653; AFOSR-80-0501TR) Avail: NTIS HC A04/MF A01 CSCL 11/2

A high-temperature isothermal instrumented impact testing apparatus was designed and built and utilized to test a variety of high performance ceramic materials at temperatures up to 1500 C. Test specimens were held on an anvil in the furnace and heated rapidly to the test temperature. An impacter broke the samples in 3 point bending, and high speed digital recorders stored the outputs of force and velocity transducers. The controlled flaw technique was utilized to obtain the critical stress intensity factor, K sub IC. Hot-pressed silicon nitride materials containing MgO, CeO2 or ZrO2 sintering aids showed a decrease in K sub IC as the temperature exceeded 1300 C. Hot-pressed silicon carbide containing alumina sintering aid showed a similar decrease. Sintered alpha-SiC, on the other hand, showed a gradual increase in K sub IC at temperatures up to 1500 C. Reaction bonded SiC failed to break at the controlled flaw, but exhibited a drop in impact fracture force at temperatures approaching the melting point of silicon. GRA

N80-30525# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.

CHEM-BRAZE ABRADABLE SEAL ATTACHMENT Final Report, 6 Oct. 1978 - 15 Oct. 1979

Charles C. McComas, Steve T. Narsavage, and Hal W. Pettit, Jr. May 1980 51 p

(Contract DAAG46-78-C-0062)

(AD-A086872; PWA-FR-12248; USAAVRADCOM-TR-80-F-5) Avail: NTIS HC A04/MF A01 CSCL 11/2

An improved Chem-Braze bonding system for attaching sintered abradable seals to compressor blade tip-shrouds was developed. The improved Chem-Braze system incorporates glycerin as an inhibitor to prevent premature evaporation which prolongs working life and allows adequate time to attach seals to engine hardware. Manufacturing guidelines including glycerin concentration, working environment, slurry thickness, bonding pressure, drying and curing parameters, and refurbishing techniques were established. Tooling techniques for attaching abradable seals to engine hardware using this improved system were selected based on a feasibility demonstration which incorporated simulated engine hardware. Nondestructive inspection (NDI) techniques for verifying bond integrity were investigated, but a satisfactory technique was not identified. A preliminary economic analysis indicated significant cost savings for attaching abradable seals to compressor blade tip-shrouds using the improved Chem-Braze system compared to attachment with gold-nickel braze. GRA

N80-30526# Hughes Research Labs., Malibu, Calif. Exploratory Studies Dept.

MOISTURE PROTECTIVE COATINGS FOR ALKALI HALIDE IR OPTICS Semiannual Report, 1 Nov. 1979 - 30 Apr. 1980

Frederick G. Yamagishi and Leroy J. Miller Jul. 1980 23 p (Contract MDA903-80-C-0096; ARPA Order 3833)

(AD-A086747) Avail: NTIS HC A02/MF A01 CSCL 11/3

The objective of this program is to develop plasma-polymerized films that are transparent, moisture-protective coatings to increase the lifetime and durability of press-forged KBr IR optical elements. Reaction conditions have been established that yield uniform films of plasma-polymerized ethane (PPE) on polished and etched single crystal KBr flats. On polishing, polycrystalline KBr formed localized grains that could not be removed by chemical etching with HBr. Surface passivation could be achieved with a plasma of CF3Br or CF2C12. An air leak in the reactor caused extensive corrosion problems with CF3Br. Repairing the leak eliminated the corrosion problem. On a concurrent IR D program, we are developing a new surface passivation method for NaCl using a non-IR-absorbing surfactant. PPE deposited on this treated surface afforded protection from damage by 98% relative humidity for 11 days. It is important to eliminate trapped free radicals in the film to reduce the chance of forming a more polar material caused by the reaction of the radicals with atmospheric oxygen. Treating the film briefly with a hydrogen plasma quenched the radicals, but the method was no more effective than the present method of storing under an ethylene atmosphere. The use of DEHA, a two hydrogen atom donor, is being studied in an IR D program as a radical quencher and may be applied to this program if it proves successful. GRA

N80-30527# Pennsylvania Univ., Philadelphia. Dept. of Physics.

PHOTOCONDUCTIVITY IN POLYACETYLENE Interim Technical Report

S. Etemad, M. Ozaki, D. L. Peebles, A. J. Heeger, and A. G. MacDiarmid 8 Jul. 1980 19 p Submitted for publication (Contracts N00014-75-C-0962; DE-AC04-79ET-23002)

(AD-A086942; LRSM-TR-80-6) Avail: NTIS HC A02/MF A01 CSCL 11/9

An extensive study of the photoconductivity together with new measurements of the absorption coefficient of polyacetylene have been carried out. It is shown that the photoconductivity in trans-(CH) sub x is controlled by localized states (inside the gap) induced either by isomerization or by dilute doping. The presence of such states and their effect on the photoconductivity of trans-(CH) sub x is accounted for by the recently proposed soliton model. GRA

N80-30528# Pennsylvania Univ., Philadelphia. Dept. of Chemistry.

MAGNETIC SOLITON DEFECTS IN POLYACETYLENE Interim Technical Report

B. R. Weinberger, E. Ehrenfreund, J. Kaufer, A. Pron, and A. J. Heeger 8 Jul. 1980 19 p refs

(Contract N00014-75-C-0962)

(AD-A086978; TR-80-1) Avail: NTIS HC A02/MF A01 CSCL 11/9

Magnetic resonance studies of undoped polyacetylene indicate a mobile defect induced upon isomerization to the trans-isomer. The unpaired spin in the pi-system is spread over approximately fourteen carbon atoms. The results are in all respects consistent with the soliton model. GRA

N80-30529# Coast Guard Research and Development Center, Groton, Conn.
THE DYNAMIC BEHAVIOR OF NYLON AND POLYESTER LINE Final Report
Kenneth R. Bitting Apr. 1980 115 p refs
(AD-A087106; CGR/DC-9/79; USCG-D-39-80) Avail: NTIS HC A06/MF A01 CSCL 11/9

Tests to determine the dynamic response of nylon and polyester, double braided and 8 strand plaited line were conducted. Line samples were excited mechanically in a tensile testing machine according to an experimental design in which frequency of excitation, mean load, and load amplitude were varied. The dynamic stiffness was measured. Samples of nylon and polyester line were placed in the ocean for 4 to 5 years and then tested with the same dynamic test procedure as was previously performed on the new line samples. The dynamic stiffness of nylon double braided line approximately doubled after five years of exposure to the marine environment, and polyester 8 strand plaited and double braided line increased about 10 to 25 percent. Snap load tests were conducted on nylon 8 strand plaited line (snap load is a cyclic loading in which zero is the minimum tension) and it was found that samples failed from fatigue when the maximum load exceeds 30 percent of the rated breaking strength. Samples do not fail by 200,000 cycles if the maximum load does not exceed 30 percent. Field and laboratory abrasion tests were also conducted on nylon, polyester, and polypropylene line of the 8 strand plaited, double braided, and 3 strand twisted constructions. R.K.G.

N80-30530# Midwest Research Inst., Golden, Colo.
PROPERTIES OF A SOLAR ALUMINA-BOROSILICATE SHEET GLASS
R. T. Coyle, M. A. Lind, J. E. Shelby, J. Vitko, and A. F. Shoemaker Jan. 1980 15 p refs Presented at the 12th Intern. Glass Congr., Albuquerque, N. Mex., 6 - 11 Jul. 1980
(Contract EG-77-C-01-4042)
(SERI/TP-334-565; CONF-800705-1) Avail: NTIS HC A02/MF A01

Solar energy applications place unique requirements on sheet glass including very low solar absorption, outstanding stability of absorption in the outdoor environment, low cost, and elastic formability for making concentrating mirrors. A solar sheet glass was developed. In evaluations reported the glass shows outstanding chemical durability and optical and mechanical properties. DOE

N80-30531# National Technical Information Service, Springfield, Va.
LUBRICATING OIL ANALYSIS FOR WEAR MONITORING. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Apr. 1980
Diane M. Cavagnaro Apr. 1980 179 p Supersedes NTIS/PS-79/0382; NTIS/PS-78/0339
(PB80-807688; NTIS/PS-79/0382; NTIS/PS-78/0339) Avail: NTIS HC $30.00/MF $30.00 CSCL 11H

The topics pertain to the chemical analysis of lubricating oils to determine and monitor the wear of engines of transmissions. The purpose of this analysis is to predict failure before it occurs in order to allow time to undertake corrective maintenance. Many of these reports are part of the Army's Spectrometric Oil Analysis Program (SOAP). Various detectors and analytical methods are cited as well and their implementation. This updated bibliography contains 172 abstracts, 11 of which are new entries to the previous edition. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N80-30532 Cornell Univ., Ithaca, N. Y.
DRY ANAEROBIC FERMENTATION TO METHANE OF ORGANIC RESIDUES Ph.D. Thesis
Walter John Wujcik 1980 253 p
Avail: Univ. Microfilms Order No. 8020903

Anaerobic fermentation was studied over a two year period with mixtures of dairy cow manure and residue material, including straw, sawdust, peat moss, and newsprint paper. Batch reactors were operated at total solid concentrations of 10 to 68.5 percent. The effect of water content, available water, and salts (sodium chloride and ammonia-nitrogen) on anaerobic fermentation to methane of dry substrates was measured. Performance was evaluated in terms of gas and methane production, substrate utilization, volatile acid production, and other parameters. The role of moisture content in the anaerobic fermentation to methane of organic residues was defined. A first order decay model was utilized to describe the kinetics of microbial decomposition for batch dry anaerobic fermentation. The relative importance of salt inhibition versus water content of the substrate was determined. Dissert. Abstr.

N80-30533 North Carolina State Univ. at Raleigh.
DEVOLATILIZATION KINETICS AND ELEMENTAL RELEASE IN THE PYROLYSIS OF PULVERIZED COAL Ph.D. Thesis
Victor Hugo Agreda 1979 428 p
Avail: Univ. Microfilms Order No. 8020475

The evolution of volatile matter and trace elements from pulverized coal during pyrolysis in an inert atmosphere was studied in batch and laminar flow furnace reactors. Five coals were investigated, ranging in rank from ignitic to anthracitic. It was determined that at any pyrolysis temperature ash losses may have a significant effect on calculated extents of devolatilization, making the commonly used ash tracer technique a potential source of error in all experimental pyrolysis studies. A technique to correct estimated weight losses for this effect was developed. An empirical mathematical model was developed to correlate the equilibrium release of Hg, Pb, Cl, As, and Se, as a function of temperature for the five coals studied. The same model was found to correlate sulfur release data for coals with rank up to bituminous. Dissert. Abstr.

N80-30534 California Univ., Davis.
DOWNDRAFT GASIFICATION CHARACTERISTICS OF MAJOR CALIFORNIA RESIDUE-DERIVED FUELS Ph.D. Thesis
Bryan Martin Jenkins 1980 385 p
Avail: Univ. Microfilms Order No. 8018978

The results of 30 fuel trials in a laboratory scale, fixed bed air blown downdraft gas producer operating at ambient pressure to produce a low-Btu fuel gas from solid agricultural, forest, and municipal residues are reported. The nature of the residue fuels, including chemical composition, energy content, and processing required to produce a suitable fuel for use in the gas producer, is also included. The nature of the products and by-products of the gasification process is discussed. Mass and energy balances on the producer are calculated for each fuel trial. The process occurring in the producer is described. The influences of fuel moisture content, air input rate, fuel ash content and the form of the fuel on producer operation are discussed. A mathematical model using the techniques of chemical equilibrium is developed to predict gas composition from the fuel composition, fuel moisture content, and air to fuel ratio. Dissert. Abstr.

N80-30535*# United Technologies Research Center, East Hartford, Conn.
AUTOIGNITION CHARACTERISTICS OF AIRCRAFT-TYPE FUELS
Louis J. Spadaccini and John A. TeVelde Jun. 1980 88 p refs
(Contract NAS3-20066)
(NASA-CR-159886; R80-914617-1) Avail: NTIS HC A05/MF A01 CSCL 21D

The ignition delay characteristics of Jet A, JP 4, no. 2 diesel, cetane and an experimental referee broad specification (ERBS) fuel in air at inlet temperatures up to 1000 K, pressures of 10, 15, 20, 25 and 30 atm, and fuel air equivalence ratios of 0.3, 0.5, 0.7 and 1.0 were mapped. Ignition delay times in the range of 1 to 50 msec at freestream flow velocities ranging from 20 to 100 m/sec were obtained using a continuous flow test apparatus which permitted independent variation and evaluation of the effect of temperature, pressure, flow rate, and

fuel/air ratio. The ignition delay times for all fuels tested appeared to correlate with the inverse of pressure and the inverse exponent of temperature. With the exception of pure cetane, which had the shortest ignition delay times, the differences between the fuels tested did not appear to be significant. The apparent global activation energies for the typical gas turbine fuels ranged from 38 to 40 kcal/mole, while the activation energy determined for cetane was 50 kcal/mole. In addition, the data indicate that for lean mixtures, ignition delay times decrease with increasing equivalence ratio. It was also noted that physical (apparatus dependent) phenomena, such as mixing (i.e., length and number of injection sites) and airstream cooling (due to fuel heating, vaporization and convective heat loss) can have an important effect on the ignition delay. R.K.G.

N80-30536# Battelle Columbus Labs., Ohio. Analytical and Environmental Chemistry Section.
ANALYTICAL TECHNIQUES FOR AROMATIC COMPONENTS IN AIRCRAFT Final Report, 15 Jun. 1978 - 30 Jun. 1979
J. Scott Warner and Richard P. Kenan Oct. 1979 87 p refs
(Contract F33615-78-C-2019; AF Proj. 3048)
(AD-A086343; AFAPL-TR-79-2093) Avail: NTIS HC A05/MF A01 CSCL 21/4

An ultraviolet detector was shown to be highly satisfactory for the selective determination of aromatic components in jet fuels. The detector was operated at 208 nm and used with a glass capillary column gas chromatographic system. The detector gave a linear response in the range of interest and could detect individual benzenes and naphthalenes in jet fuels at levels down to 0.1% and 0.02% respectively. A photoionization detector having a 9.5 eV source was found to be not sufficiently selective for aromatic hydrocarbons to be of value for fuel characterization. GRA

N80-30537# Naval Research Lab., Washington, D. C. Lab. for Computational Physics.
SIMULATIONS OF GAS PHASE DETONATION: INTRODUCTION OF AN INDUCTION PARAMETER MODEL
E. S. Oran, J. P. Boris, T. R. Young, Jr., M. Flanigan, M. Picone, and T. Burks (Science Applications, Inc., McLean, Va.) 25 Jun. 1980 34 p refs
(RR024241)
(AD-A087007; AD-E000488; NRL-MR-4255) Avail: NTIS HC A03/MF A01 CSCL 19/1

Detailed numerical simulations of supersonic reactive flow and gas phase detonation problems are very expensive due to their computer time and memory requirements. The bulk of this cost is in integrating the ordinary differential equations describing chemical reactions. A global induction parameter model has thus been developed which describes the chemical induction time of a mixture and allows for release of energy over a finite time period. The specific gases for which it has been calibrated are stoichiometric mixtures of hydrogen and methane in air. The relatively inexpensive induction parameter model is then used in time-dependent one and two dimensional simulations of supersonic reactive flows. GRA

N80-30538# Institute of Gas Technology, Chicago, Ill.
PROCESS EVALUATION: STEAM REFORMING OF DIESEL FUEL OIL Final Technical Report, 24 Apr. - 24 Dec. 1979
George A. Jarvi, Ronald M. Bowman, Elias H. Camara, and Anthony L. Lee 15 Feb. 1980 51 p refs
(Contract DAAK70-79-C-0048)
(AD-A087053) Avail: NTIS HC A04/MF A01 CSCL 21/4

This project is an evaluation of a proprietary catalyst as a means of steam-reforming diesel fuel oil (Fed. Spec. VV-F-800B, symbol DF-2). A system for testing the catalyst has been designed, built and successfully used to screen operating conditions of temperature, space velocity, and H2O/C ratio. A duration test has been conducted showing the catalyst capable of steam reforming diesel fuel, but with the production of naphthalene after 30 hours. Hydrogen production remained stable through the 86 hours of the test. GRA

N80-30539# Army Armament Research and Development Command, Dover, N. J. Large Caliber Weapon Systems Lab.
EXPLOSIBILITY OF EXPLOSIVE AND PROPELLANT DUST Final Report
W. T. Moore, P. Lu, S. Roorda, B. Fishburn, N. Slagg, R. M. Rindner, and W. Seals Jul. 1980 43 p refs
(AD-A087240; AD-E400449; ARLCD-TR-79045) Avail: NTIS HC A03/MF A01 CSCL 09/4

A specially designed flow system was constructed to obtain more detailed data on the effect of particle size and concentration on the spark ignition of propellant and explosive dusts. With this apparatus the concentration can be controlled over a 1.5 m (5 ft), and streak photography can be employed to determine the velocity of flames and/or explosion waves. Thus information on both ignition and propagation can be obtained. The ignition characteristics of M1 propellant, RDX, HMX, and ball powder were determined. The concentration was varied from 0.15 to 1.5 g/liter, and the particle size was from 75 to 225 micrometers. Ignition with subsequent flame propagation required a concentration of at least 0.15 to 0.3 g/liter for all dusts tested. Values from previous studies conducted in a Hartmann apparatus ranged from 0.1222 g/liter to 0.5 g/liter for some of the same materials with similar particle sizes. Thus the lower limits of ignition are in good agreement; however, due to the relatively small size of the Hartmann apparatus, direct comparisons of ignition at upper limits are difficult. GRA

N80-30540# Rockwell International Corp., Canoga Park, Calif. Energy Systems Group.
PARTIAL LIQUEFACTION OF COAL BY DIRECT HYDROGENATION Quarterly Progress Report, Oct. - Dec. 1979
A. Y. Falk 1980 38 p
(Contract EX-76-C-01-2044)
(FE-2044-51) Avail: NTIS HC A03/MF A01

Fifteen additional reactor tests with an average duration of 1 hour each were made in the 1 TPH process development unit (PDU). The water cooled heat recovery quench unit was employed for all these tests. In general, operation of the PDU is progressing smoothly. No significant operational/hardware problems were encountered. The new product recovery system and heat recovery quench unit appear to be functioning well and as designed. Analysis of results from the tests conducted employing the heat recovery quench unit indicates carbon conversion results that are consistent with the results of the previous testing. Tables summarizing the test conditions and carbon conversion results, product gas compositions, and liquids (heavy and light oils) properties are presented. DOE

N80-30541# Brigham Young Univ., Provo, Utah.
ALLOY CATALYSTS WITH MONOLITH SUPPORTS FOR METHANATION OF COAL-DERIVED GASES Quarterly Technical Progress Report, 21 Jun. - 20 Sep. 1979
Calvin H. Bartholomew 5 Oct. 1979 40 p refs
(Contract EF-77-S-01-2729)
(FE-2729-8) Avail: NTIS HC A03/MF A01

Kinetic studies of monolithic Ni/Al2O3 revealed a shift in activation energy for methanation of CO above 573 K. In kinetic studies at high pressure rapid deactivation was observed for low loading monolithic catalysts. A one dimensional computer model for methanation over monolithic catalysts was developed to provide insight into experimental conversion vs. temperature data taken in this laboratory. A method for qualitatively determining sulfur on poisoned catalysts was developed and tested. Metal crystallite size distribution data obtained from transmission electron micrograph (TEM) studies on Ni/silica catalysts suggest that sintering may occur by both crystallite and atomic migration mechanisms. The TEM studies of 3% Ni/TiO2 reveal the presence of raft-like crystallites. These and other accomplishments are reported and discussed. DOE

N80-30542# Institute of Gas Technology, Chicago, Ill.
EXPERIMENTAL PROGRAM FOR THE DEVELOPMENT OF PEAT GASIFICATION. TASK 2: HYDROGASIFICATION. TASK 3: FLUIDIZED-BED TESTS Interim Report, 1 Oct. 1978 - 31 Jul. 1979
Feb. 1980 72 p refs
(Contract EX-76-C-01-2469)
(FE-2469-48; IR-7) Avail: NTIS HC A04/MF A01

The effects of temperature, hydrogen partial pressure, residence time, and particle size on product distribution and yields were determined. A total of thirty tests were conducted in an

entrained flow hydrogasification process development unit with Minnesota, North Carolina, and Maine peats. These tests were conducted at temperatures of about 1000 to 1500 F, hydrogen partial pressures of 0 to 250 psia, residence times of 2 to 30 seconds, and particle sizes of -10+100, -10+20, and -60+120 mesh. The results show that overall carbon conversion and hydrocarbon gas yield for the Minnesota peat are about 20% and 50% higher than those for North Carolina and Maine peats, respectively. R.C.T.

N80-30543# Puerto Rico Univ., Rio Piedras. Center for Energy and Environment Research.

PRODUCTION OF SUGARCANE AND TROPICAL GRASSES AS A RENEWABLE ENERGY SOURCE Quarterly Reports, 1 Jun. - 30 Nov. 1979

A. G. Alexander 1979 73 p refs

(Contracts ET-78-S-05-5912; DE-AS05-78ET-20071)

(ORO-5912-T3; AES-UPR-C-481; QR-1/2) Avail: NTIS HC A04/MF A01

The principal yield trends for biomass included: (1) increased yields with delay of harvest frequency; (2) lack of response to narrow row spacing; and (3) lack of appreciable yield differences between varieties when allowed to reach maturity. First ratoon yields for both sugarcane and napier grass significantly exceeded the plant crop yields. For sugarcane, the average production of millable cane was 88.6 tons/acre year. Total dry matter (including trash) averaged 33.6 tons/acre year. Second year yield increases consisted largely of dry matter (32%) as opposed to green material (18%). The highest napier grass yields were about 91 green tons and 33 dry tons/acre year, approximately 29% and 35% higher than the year 1 output. Production costs for sugarcane amounted to $25.46/oven-dry ton, or about $1.70/million BTUs. Puerto Rico is presently paying around $4.00/million BTUs in the form of imported bunker C residual oil. Sucrose yields were quite low, averaging 6.6%, but total fermentable solids were comparable to the commercial sugarcane yields in Puerto Rico. L.F.M.

N80-30544# Chevron Research Co., Richmond, Calif.

REFINING AND UPGRADING OF SYNFUELS FROM COAL AND OIL SHALES BY ADVANCED CATALYTIC PROCESSES. LABORATORY AND PILOT PLANT STUDIES OF THE PROCESSING OF SRC-1 Interim Report

R. F. Sullivan, B. E. Stangeland, H. C. Chen, and C. E. Rudy Nov. 1979 80 p

(Contract EX-76-C-01-2315)

(FE-2315-45; IR-2) Avail: NTIS HC A05/MF A01

Solvent refined coal (SRC) from the SRC-1 process is a high melting solid material that contains large amounts of nitrogen, oxygen, and metallic contaminants and is low in hydrogen content. It is a feed that is extremely difficult to convert to transportation fuels in high yields using commercial fixed bed, catalytic hydroprocessing technology. It was demonstrated that SRC 1 can be hydrotreated in the presence of a coal derived solvent at moderate cracking conversions (e.g., 50% conversion to material boiling below 850 F) for at least 1000 hours without serious plugging of the catalyst bed. However, even at these relatively low conversion levels, catalyst deactivation rates are unacceptably high. With higher severity hydroprocessing, high conversion can be obtained and most of the heteroatoms can be removed. However, severe plugging occurs in the catalyst beds in a short period of time. We do not regard conversion of SRC-1 to transportation fuels by the routines here as being commercially feasible. DOE

N80-30545# UOP, Inc., Des Plaines, Ill.

UPGRADING OF COAL LIQUIDS: HYDROCRACKING OF EDS PROCESS DERIVED GAS OILS Interim Report

Frederick J. Riedl and Armand J. DeRosset Nov. 1979 120 p

(Contract EF-77-C-01-2566)

(FE-2566-33) Avail: NTIS HC A06/MF A01

The applicability of commercial UOP catalysts and processes for hydrocracking coal derived distillates, produced by the Exxon Donor Solvent (EDS) process was evaluated. Process conditions within commercial ranges were selected to produce either fuel oil or gasoline. Hydrocracking was done in two stages. When operating in the gasoline mode, the first stage produced a high nitrogen product to be used in a series flow, two reactor, second stage hydrocracking process. When operating in the fuel oil mode, first stage operation produced a low nitrogen product to be used in a single reactor second stage hydrocracking process. The volumeric yields of C5(+) gasoline and butanes from the gasoline mode operation ranged from 105 to 115.5% and 18 to 26%, respectively. The octane number of the C5(+) gasoline ranged from 75 to 83 RON clear. The overall hydrogen consumption ran from 3300 to 4200 SCF/bbl, all of which can be supplied by reforming the gasoline and steam reforming the C1 to C4 gases. In the fuel oil mode, yield of environmentally acceptable distillate was about 88%. DOE

N80-30546# Battelle Columbus Labs., Ohio.

THERMOPHYSICAL PROPERTIES OF COAL LIQUIDS Quarterly Technical Status Report, 1 Jan. - 31 Mar. 1980

J. W. Droege, G. H. Stickford, and S. P. Chauhan 15 Apr. 1980 31 p

(Contract DE-AC01-79ET-14941)

(BMI-2053; QTSR-2) Avail: NTIS HC A03/MF A01

Certain physical properties of coal solvent slurries, namely, viscosity, thermal conductivity, density, heat of reaction, and specific heat, as these slurries undergo dissolution reactions were determined. Major modifications to the viscometer were made, providing a lifting force more nearly constant with position of the bob, and a sensing coil for velocity measurements which gives a signal linear with velocity. The viscometer was calibrated with a series of liquids with a variety of viscous properties. The calibration constant varies somewhat with viscosity. A transient line source technique was selected for thermal conductivity measurements. A thin vertical wire acts both as heater and thermometer. When a current is passed through the wire, its temperature changes in a manner that depends partly on the thermal conductivity of the surrounding medium. Density determinations may be possible as a byproduct of the viscosity work. DOE

N80-30547# Mobil Research and Development Corp., Paulsboro, N. J. Processes Research and Technical Service Div.

UPGRADING OF COAL LIQUIDS FOR USE AS POWER GENERATION FUELS Final Report

P. J. Angevine, M. Becker, R. B. Callen, M. J. Dabkowski, M. P. Granchi, L. A. Green, R. H. Heck, C. A. Simpson, S. S. Shih, and T. R. Stein Dec. 1979 247 p refs Sponsored by Electric Power Research Inst.

(EPRI Proj. 361-2)

(EPRI-AF-1225) Avail: NTIS HC A11/MF A01

Residual coal liquids were hydroprocessed in fixed bed unit to upgrade them to power generation fuels. A series of catalysts was evaluated for the desulfurization of short contact time (SCT) Solvent Refined Coal (SRC). Low sulfur (0.4 wt %) boiler fuels were produced with hydrogen consumptions as low as 800 and 1200 scf/B from Indiana 5 regular SRC and W. Kentucky SCT SRC, respectively. Constant temperature aging runs were conducted with both regular and short contact time SRC. A kinetic aging model was developed to estimate process conditions and yields in either a fixed bed or ebullated bed reactor. Chemical characterization indicated that W. Kentucky SCT SRC molecules are significantly larger and more polar than those of Indiana 5 regular SRC. The high conversion of asphaltenes to less polar material does not appear necessary for SRC desulfurization. DOE

N80-30548# Westinghouse Electric Corp., Madison, Pa. Advanced Coal Conversion Dept.

ADVANCED COAL GASIFICATION SYSTEM FOR ELECTRIC POWER GENERATION Quarterly Progress Report, 1 Oct. - 31 Dec. 1978

H. K. Altiner, M. J. Arthurs, E. J. Chelen, P. Cherish, Z. F. Hudson, S. Katta, D. L. Keairns, L. K. Rath, N. D. Rohatgi, L. A. Salvador et al 30 Jun. 1979 137 p ref

(Contract EF-77-C-01-1514)

(FE-1514-97) Avail: NTIS HC A07/MF A01

The operation of the PDU focused on testing of the single stage gasifier system using numerous coal feedstocks and oxygen and steam as the gasification media. Operating summaries with the significant results of these tests are described. Test TP-018-5 was the last shakedown test in an experimental test grid with highly caking Pittsburgh seam coal. This test grid was designed to show the effects of varying the oxygen and steam

flows on the higher heating value of the product gas on a dry basis. In addition, a slight modification to the oxidant tube geometry was examined during this test as well as in tests TP-019-1 and TP-019-2. The operability of the oxygen blown gasifier on more highly reactive feedstocks was explored in the TP-019 test series. Three coals successfully gasified ranged from Montana Rosebud sub-bituminous coal to two highly volatile bituminous B rank coals: Indiana No. 7 and Western Kentucky No. 9. DOE

N80-30549# Utah Univ., Salt Lake City. Dept. of Mining and Fuels Engineering.
APPLIED RESEARCH AND EVALUATION OF PROCESS CONCEPTS FOR LIQUEFACTION AND GASIFICATION OF WESTERN COALS Quarterly Progress Report, Jul. - Dec. 1979
Wendell H. Wiser Mar. 1980 12 p refs
(Contracts EX-76-C-01-2006; EI-49-18-2006)
(FE-2006-17) Avail: NTIS HC A02/MF A01

The experimental work on coal dissolution in hydrogen donor solvents was completed. The data are analyzed and interpreted to explain the major structural features of each high volatile bituminous coal examined. The findings are related to the heterogeneity, polymeric nature, aromaticity, aromatic cluster size and distribution of the clusters in the coal. The results are specific to the particular coal, but agree generally with the current understanding of coal structure. The effects of pressure, temperature, and contact time on sulfur removal were determined at a constant hydrogen/oil feed ratio of 5000:1 std cc H2/cc oil, one specific catalyst bed weight (equivalent stationary bed heights of about 5 in.) and one catalyst particle size (49 micron average diameter). Within the chosen operating range, the SRC allowed smooth and stable operation of the fluid bed without any agglomeration of the catalyst particles. Some typical results are shown. DOE

N80-30550# Oak Ridge National Lab., Tenn. Chemical Technology Div.
SIMULTANEOUS PHOTOPRODUCTION OF HYDROGEN AND OXYGEN BY PHOTOSYNTHESIS
Elias Greenbaum 1979 21 p refs Presented at 2d Symp. on Biotechnol. in Energy Production and Conserv., Gatlinburg, Tenn., 2-5 Oct. 1979
(Contract W-7405-eng-26)
(CONF-791072-32) Avail: NTIS HC A02/MF A01

Results suggest that the photosynthetic production of hydrogen and oxygen represents an intriguing way to capture and convert solar energy into stored chemical free energy. It is particularly noteworthy that all three of the only known potential, direct photosynthetic watersplitting systems - blue-green algae, green algae, and the chloroplast-ferredoxin-hydrogenase system, have now been shown to photoproduce molecular hydrogen and oxygen simultaneously for prolonged periods of time. DOE

N80-30551# Argonne National Lab., Ill. Materials Science Div.
***MATERIALS TECHNOLOGY FOR COAL-CONVERSION PROCESSES* Progress report, Jul. - Dec. 1979**
1980 95 p refs
(Contract W-31-109-eng-38)
(ANL-80-12; PR-19) Avail: NTIS HC A05/MF A01

Analysis of refractories exposed to slag attack during the last 500 h test run shows that complex spinels formed at the slag refractory interfaces of the chrome-spinel, alumina-chromia, and alumina refractories. Silicon carbide refractories reacted with iron oxides and produced a low melting ferrosilicon alloy and CO or CO2 gas. A high temperature ultrasonic erosion scanner was installed and field tested at the Solvent Refined Coal (SRC) coal liquefaction plant. Automatic data acquisition was accomplished through direct coupling to the SRC on site computer. The scanner has detected erosive wear in the SRC erosion corrosion test loop. Results suggest that as exposure time increases, a greater oxygen partial pressure is required for breakaway corrosion. Synergistic erosion corrosion studies conducted in a simulated coal gasification atmosphere at 815 C, with 150 Al2O3 at 22 m/s as erodant, show that Incoloy 800 was the most corrosion resistant alloy tested and 1015 carbon steel the least resistant. DOE

N80-30552# Gilbert Associates, Inc., Reading, Pa.
RESEARCH AND EVALUATION OF BIOMASS RESOURCES/ CONVERSION/UTILIZATION SYSTEMS (MARKET/ EXPERIMENTAL ANALYSIS FOR DEVELOPMENT OF A DATA BASE FOR A FUELS FROM BIOMASS MODEL) Quarterly Technical Progress Report, 1 Nov. 1979 - 31 Jan. 1980
Yong K. Ahn, Yung C. Chen, Herbert T. Chen, Richard W. Helm, Eric T. Nelson, Kevin J. Shields, Richard P. Stringer, and Richard C. Bailie (West Virginia Univ., Morgantown) 1980 106 p
(Contracts ET-78-C-02-5022; DE-AC02-78ET-20611)
(DOE/ET-20611/11) Avail: NTIS HC A06/MF A01

The biomass allocation model was developed and is undergoing testing. Data bases for biomass feedstock and thermochemical products are complete. Simulated data on process efficiency and product costs are being used while more accurate data are being developed. Process models for entrained bed and fixed bed gasifiers based on coal were adapted to biomass. Conceptual economics were generated for seven of the fourteen process configurations via a biomass economic computer program. Pulse tests in a fluidized bed to determine the effect of particle size on reaction rates and product gas composition were completed. Two hour shakedown tests using peanut hulls and wood as the biomass feedstock and the fluidized bed reactor mode were carried out. A comparison was made of the gas composition using air and steam. To date approximately 70 biomass types were collected. Thermal gravimetric, pyrogaschromatographic and effluent gas analysis were began on pelletized samples of these biomass species. DOE

N80-30553# IIT Research Inst., Chicago, Ill.
DESIGN AND EVALUATION OF PROGRESSIVELY BURNING PYROTECHNIC FORMULATIONS
James L. Austing and Paul W. Cooper 1980 24 p refs Presented at the 7th Intern. Pyrotechnics Seminar, Vail, Colo., 14 Jul. 1980 Prepared in cooperation with Sandia Labs., Albuquerque, N. Mex.
(Contract EY-76-C-04-0789)
(SAND-80-0355C; CONF-800713-1) Avail: NTIS HC A02/MF A01

The design and evaluation of a pyrotechnic that burns for 2 ms and generates gas cubically with time is described. The charge is a mixture of two aluminum-plated pyrotechnics, viz., aluminum-potassium perchlorate (Al-KC104) and aluminum-vanadium pentoxide (Al-V2O5). The Al-KC104 is a gas generator, each gram of which produces 320 cc of gas (STP); the Al-V2O5, on the other hand, is a gasless pyrotechnic. Progressive generation of gas is achieved by utilizing mixtures of two pyrotechnics in increments that are progressively richer in gas generant, over a range of 14.6% to 100% Al-KC104 by weight. The deflagration rate of the system is a function of the Al-KC104 content, and ranges from 16.2 in./msec for a mixture with 14.6% Al-KC104 by weight to 30.0 in./msec for pure Al-KC104. An evaluation of the pyrotechnic charge fired in air showed that the design goals were adequately achieved. The growth of the gas cloud was monitored by high speed Fastax photography. DOE

N80-30554# Rockwell International Corp., Canoga Park, Calif. Energy Systems Group.
MOLTEN SALT COAL GASIFICATION PROCESS DEVELOPMENT UNIT Quarterly Technical Progress Report, Apr. - Jun. 1979
M. H. Slater 30 Sep. 1979 56 p
(Contract EF-77-C-03-1429)
(SAN-1429-52; QTPR-13) Avail: NTIS HC A04/MF A01

The design, construction, and operation of a process development unit (PDU) which will convert 1 ton of coal per hour into low Btu gas is described. The third successful gasification run was performed. The solids feed system, the combustion air system, the gasifier/quench system, the ash removal system, the sulfur removal system, and the sodium carbonate regeneration system were all operated simultaneously as a single, integrated unit. The gasifier was operated at atmospheric pressure for a total of 272 continuous hours. Gas was produced with an average HHV of 88.6 Btu/scf while gasifying coal at a rate of 400 lb/hr. DOE

N80-30555# Argonne National Lab., Ill. Systems Engineering and Technology Group.
ENVIRONMENTAL IMPLICATIONS OF ACCELERATED GASOHOL PRODUCTION: PRELIMINARY ASSESSMENT
Jan. 1980 129 p refs
(Contract W-31-109-eng-38)
(ANL/ES-91) Avail: NTIS HC A07/MF A01

The environmental impacts of increasing US production of fuel ethanol by 330 million gallons per year in the 1980 to 1981 time frame in order to substitute gasohol for 10% of the unleaded gasoline consumed in the United States are assessed. Alternate biomass feedstocks are examined and corn is selected as the logical feedstock, based on its availability and cost. Three corn conversion processes that could be used to attain the desired 1980 to 1981 production are identified; fermentation plants that use a feedstock of starch and wastes from an adjacent corn refining plant are found to have environmental and economic advantages. If ethanol production is increased substantially after 1981, the environmentally acceptable use or disposal of stillage, a liquid by product of fermentation, could become a serious problem. DOE

N80-30556# Westinghouse Electric Corp., Pittsburgh, Pa. Advanced Energy Systems Div.
SECOND PHASE OF A COALBED METHANE EXTRACTION AND UTILIZATION PROGRAM
Apr. 1980 140 p
(Contract DE-AC21-78MC-08332)
(AESD-TM-3026) Avail: NTIS HC A07/MF A01

The coalbed site was further explored to improve its definition as a methane fuel reservoir and to develop the design of a system capable of providing a large scale demonstration of the recovery of coalbed methane and utilization of it in an industrial application, i.e., process heat and electric power. Three new wells were cored and drill stem testing was conducted on two of them. The site was evaluated as containing 7960 mcf of coalbed methane per acre. The producing well, previously developed, continued in operation except for brief periods of shutdown for equipment maintenance. The well attained a peak flow rate of 85.3 mcf/day and an average daily flow rate in excess of 38 mcf. L.F.M.

N80-30557# Battelle Columbus Labs., Ohio.
THERMOPHYSICAL PROPERTIES OF COAL LIQUIDS Quarterly Technical Status Report, 1 Oct. - 31 Dec. 1979
J. W. Droege and S. P. Chauhan 21 Jan. 1980 9 p
(Contract DE-AC01-79ET-14941)
(BMI-2043; QTSR-1) Avail: NTIS HC A02/MF A01

Certain physical properties of coal solvent slurries are to be determined as these slurries undergo dissolution reactions. The properties are viscosity, thermal conductivity, density, heat of reaction, and specific heat. Development of an experimental plan was completed and some of the needed equipment was placed on order. Exploratory viscosity measurements were made, showing the need for several modifications and disclosing the nature of the stirring difficulties to be anticipated. DOE

N80-30558# Argonne National Lab., Ill.
US DEPARTMENT OF ENERGY'S METHANE FROM LANDFILLS PROGRAM
Michael L. Wilkey 1979 10 p Presented at the Biogas and Alc. Production Conf., Chicago, 25 Oct. 1979
(Contract W-31-109-eng-38)
(CONF-7910126-1) Avail: NTIS HC A02/MF A01

Energy savings and recovery from urban waste streams through participation in the development, evaluation, and implementation of the technologies necessary for recovery, processing, and utilization of combustible gases generated in landfills are considered. The feasibility of landfill gas recovery and use, as well as future optimization techniques and methods, are examined. DOE

N80-30559# Environmental Protection Agency, Ann Arbor, Mich. Test and Evaluation Branch.
EVALUATION OF XRG NO. 1: A FUEL ADDITIVE
Edward Anthony Barth Feb. 1980 16 p refs
(PB80-180672; EPA-AA-TEB-80-12) Avail: NTIS HC A02/MF A01 CSCL 21D

XRG No. 1, a fuel additive developed to increase fuel efficiency in automobiles, is evaluated. Contrary to the manufacturer's claims, the test results showed neither a general increase in fuel economy nor a decrease in emissions associated with the addition of XRG No. 1 to the fuel. GRA

N80-30560# National Technical Information Service, Springfield, Va.
HYDROGEN STORAGE: STORAGE AS A GAS OR LIQUID. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1974 - May 1980
Diane M. Cavagnaro Jun. 1980 151 p Supersedes NTIS/PS-79/0581; NTIS/PS-78/0546 Updates NTIS/PS-75/379 (PB80-811086; NTIS/PS-79/0581; NTIS/PS-78/0546; NTIS/PS-75/379) Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 21D

The bibliography relates to storing hydrogen as a liquid or a gas. Topics include fuel storage, energy storage, and the construction of tanks used to store the material. Any type of storage that is related to batteries, fuel cells, or solar cells are excluded, unless the abstract states that its purpose is to store hydrogen. This updated bibliography contains 144 abstracts, 18 of which are new entries to the previous edition. GRA

N80-30561# National Technical Information Service, Springfield, Va.
HYDROGEN STORAGE: HYDROGEN AS A HYDRIDE. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1974 - May 1980
Diane M. Cavagnaro Jun. 1980 142 p Supersedes NTIS/PS-79/0582; NTIS/PS-78/0547 Updates NTIS/PS-75/379 (PB80-811094; NTIS/PS-79/0582; NTIS/PS-78/0547) Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 21D

The bibliography covers hydrogen storage as a hydride. Topics include the chemical and physical properties of the hydride, and how useful it may be for hydrogen storage. Also considered is the conversion of hydrogen to a hydride and the conversion back to hydrogen. This updated bibliography contains 135 abstracts, 14 of which are new entries to the previous edition. GRA

N80-30407 Auburn Univ., Ala. Dept. of Chemistry.
SYNTHESIS OF CMP BEGINNING WITH SODIUM BOROHYDRIDE
F. A. Johnson and W. E. Hill *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 413-422 (For primary document see N80-30381 21-20)
(Contract DASG60-78-C-1043)
Avail: Issuing Activity CSCL 21/8

N80-30408 Callery Chemical Co., Pa.
PYROLYSIS OF (C2H5)4NBH4 TO [(C2H5) 4N] 2B10H10: USE OF A LIQUID HEAT TRANSFER MEDIUM
J. L. Little and R. M. Hunt *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 423-433 refs (For primary document see N80-30381 21-20)
(Contract DASG60-78-C-0146)
Avail: Issuing Activity CSCL 21/8

N80-30418 Thiokol Corp., Brigham City, Utah. Wasatch Div.
LLMM SRAM 3-D GRAIN STRUCTURAL ANALYSIS
A. W. Macbeth *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 595-612 (For primary document see N80-30381 21-20)
Avail: Issuing Activity CSCL 21/8

N80-30419 Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio. Fuels Branch.
LIQUID AIRBREATHING MISSILE FUELS: AN OVERVIEW OF PROPERTIES AND APPLICATIONS
James R. McCoy *In* APL The 1980 JANNAF Propulsion Meeting, Vol. 5 Mar. 1980 p 613-619 refs (For primary document see N80-30381 21-20)
Avail: Issuing Activity CSCL 21/8

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N80-30562 California Univ., San Diego, La Jolla.
PLANAR MECHANICS OF FULLY GROUTED CONCRETE MASONRY Ph.D. Thesis
Robert Oakford Nunn 1980 126 p
Avail: Univ. Microfilms Order No. 8018792

A continuum model for the behavior of fully grouted concrete masonry is developed. Both unreinforced and reinforced masonry are considered, but otherwise attention is restricted to a single material type. Data were taken from prisms of several configurations, and from 5 foot square panels cut at an angle relative to the joint system. The panels were tested under direct biaxial stresses with one edge in tension and the other in compression or stress free. The elastic behavior is found to be linear. The form of the elastic law describing this behavior is determined and the moduli are evaluated showing substantial anisotropy in stiffness. Hysteresis loops at several load rates are described, and the relation of these loops to the damping of structure is discussed. The significance of prism configuration and end conditions, and the relation of prism compressive strength to wall compressive strength are discussed. A law describing the dependence of unreinforced uniaxial tensile strength on direction shows moderate anisotropy in tensile strength and is incorporated into a law of unreinforced biaxial strength for the special case of principal stresses of opposite sign. Dissert. Abstr.

N80-30563 Cornell Univ., Ithaca, N. Y.
MICROCRACKING AND ENGINEERING PROPERTIES OF HIGH-STRENGTH CONCRETE Ph.D. Thesis
Ramon Luis Carrasquillo 1980 270 p
Avail: Univ. Microfilms Order No. 8020801

The differences in mechanical properties between high strength and normal strength concretes are established and those differences are explained in terms of differences in observed internal microcracking in concrete at different stages of loading. Concretes made using gravel and crushed limestone coarse aggregates at each of three different strength levels ranging from 4,000 psi to 11,000 psi were studied. The results of the microcracking study and the study of the mechanical properties are presented. A criterion for definition of failure in uniaxial compression for the concretes tested is presented. Failure is considered to occur at the discontinuity point defined as that point when a self propagating microcracking mechanism is developed eventually causing disruptive failure with time. The predicted stress and strain ratios at discontinuity based on the microcracking study are compared to those at which sudden changes occur in the Poisson's ratio and volume change curves. Dissert. Abstr.

N80-30564# Naval Research Lab., Washington, D. C.
SUBMICROSECOND COMPARISONS OF TIME STANDARDS WITH THE NAVIGATION TECHNOLOGY SATELLITES (NTS) Interim Report, May - Sep. 1978
J. Buisson, T. McCaskill, J. Oaks, D. Lynch, and C. Wardrip
30 Apr. 1980 14 p refs Submitted for publication
(AD-A086780; AD-E000459; NRL-8395) Avail: NTIS
HC A02/MF A01 CSCL 14/2

During May through September 1978 a six nation cooperative experiment was performed to intercompare time standards of major laboratories at the submicrosecond level using NTS satellites. NTS time transfer receivers, which were developed for use with the NTS series of satellites, were installed at the Division of National Mapping (DNM), Australia; in Japan at the Radio Research Laboratories (RRL) and the National Research Laboratory of Metrology (NRLM); National Research Council (NRC), Canada; Royal Greenwich Observatory (RGO), England; Bureau International de l'Heure, France (BIH); Institute for Applied Geodesy (IFAG), West Germany; and in the U.S. at the Goddard Space Flight Center (GSFC), National Bureau of Standards (NBS), Naval Research Laboratory (NRL), and the Naval Observatory (USNO). The results obtained by satellite were compared to those obtained by portable clocks. At all stations the differences were less than 0.75 microseconds. The RMS of the data from nine stations is less than 0.4 microseconds. GRA

N80-30565# EG and G Washington Analytical Services Center, Inc., Rockville, Md.
MOORING DYNAMICS: COMPUTER MODELS AND EXPERIMENTS AT A SIXTY FOOT SCALE
David B. Dillon Jul. 1980 95 p refs
(Contract N00014-78-C-0273)
(AD-A086854; EG/G-TR-4999-0004) Avail: NTIS
HC A05/MF A01 CSCL 20/4

The U.S. Navy Civil Engineering Laboratory is conducting a series of dynamic cable experiments in order to evaluate computer models of cable systems used in the ocean. The results of an experiment using 60 foot cables are compared to two computer simulations in this report. Other experiments at scales of six feet and 2,500 feet have been performed. Three cases from the experiment conducted in the hydroballistics tank of the Naval Surface Weapons Center in 1976 are compared to the SNAPLOAD and SEADYN computer models. Two of the runs simulate the anchor-last deployment of a mooring, the third shows the relaxation of a mooring displaced laterally, then released. The quality of the experimental data is evaluated by comparing each case to the static, elastic catenary equations at the start and finish of each run. The measured positions of points along the static catenaries are found typically to agree with the catenary calculations within 1 to 2 percent of the cable length. Tension measured at the fixed end typically agrees with the calculated value within about 12 percent. GRA

N80-30566# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
HYDRODYNAMICS OF TURBOMACHINES Final Report
A. J. Acosta May 1980 7 p refs
(Contracts N00014-67-A-0094; N00014-76-C-0156)
(AD-A086873) Avail: NTIS HC A02/MF A01 CSCL 13/10

The present concerns have been primarily with applications to flows of liquids in turbomachines rather than gases. Each medium has its own special problems in addition to the common basis in fluid mechanics. Liquid flows in particular are subject to cavitation when the pressure falls below the vapor pressure. Cavitation is a major element in many applications of naval hydrodynamics. Here the 'turbomachine' is the propulsion system and cavitation on the components of this system, primarily the rotor or propeller, may cause intense noise, if the extent of cavitation is small, significant material erosion if there is a somewhat larger amount of cavitation, or a major performance change (loss of thrust, efficiency, etc.) when there is a large extent of cavitation. The establishment of conditions for the onset of cavitation is then an important feature in almost all naval hydrodynamic applications. Just this particular problem has been the source of much recent effort in cavitation inception research and has been a feature of some of the present work herein. GRA

N80-30567# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Geotechnical Lab.
USE OF FABRICS AND OTHER MEASURES FOR RETARDING REFLECTIVE CRACKING OF ASPHALTIC CONCRETE OVERLAYS Final Report
Ralph D. Jackson Mar. 1980 22 p refs
(Contract DOT-FA78WAI-837)
(AD-A085851; WES/MP/GL-80-2; FAA-RD-80-8) Avail: NTIS
HC A02/MF A01 CSCL 13/2

Prevention or control of reflection cracks in asphaltic concrete overlays has been a problem from the inception of this type of construction. The many different treatments that have been tried in an effort to solve this problem are: (1) reinforcement within and below the overlay, (2) bond breakers, (3) stress relieving layers, (4) asphalt-mix additives, and (5) placement of fabrics between the existing pavement and the overlay. At the present time, no treatment has been tried that will completely prevent the formation of reflection cracks. Some treatments do delay the formation of cracks, while others do not appear to help at all. Indications are that fabrics do have some beneficial effects, such as a moisture barrier, even though the overlays develop reflection cracks. The fabrics that have been tried for the control of reflection cracks included: (1) Petromat, (2) Bidim, (3) Typar,

(4) Carex, (5) Mirafi, (6) Structofors, (7) Bituthene, (8) Protecto-Wrap, and (9) Fiberglass. Asphalt-rubber interlayers, as formulated by the Arizona Refining Company and the Sahuaro Petroleum Company, show promise in retarding reflection cracks. GRA

N80-30568# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.

CENTER OF GRAVITY Final Report

18 Jul. 1980 11 p

(AD-A086951; TOP-2-2-800) Avail: NTIS HC A02/MF A01 CSCL 14/2

This report describes standard techniques for determining the center of gravity of heavy equipment including vehicles and large weapons. It covers suspension, reaction, and weighing methods and includes procedures for calculating the combined center of gravity of two or more masses when attached to each other and considered a single unit. It discusses error factors and factors to be considered in selecting the appropriate method. These techniques apply to wheeled and tracked vehicles, trailers, large weapons, construction equipment, and certain types of warehouse and shop equipment. GRA

N80-30569# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.

SAFETY AND HEALTH HAZARD EVALUATION, GENERAL EQUIPMENT Final Report

6 May 1980 22 p

(AD-A086990; TOP-10-2-508) Avail: NTIS HC A02/MF A01 CSCL 09/3

This TOP describes development test procedures required to determine whether general equipment is free from design, operational or maintenance hazards which could prevent accomplishment of their intended mission. Checklists and a hazard analysis format are provided to assist test personnel in the assessment of hazards. GRA

N80-30570# Lehigh Univ., Bethlehem, Pa.

MANUFACTURE OF SUPERCONDUCTING WIRE Progress Report, 1 Feb. - 15 Oct. 1979

B. Avitzur, Y. T. Chou, S. Talbert, and R. Wu Oct. 1979 79 p refs

(Contract DE-AC02-79ER-10367)

(DOE/ER-10367/2) Avail: NTIS HC A05/MF A01

Aspects of the manufacturing technology for superconducting wires are addressed. The typical present day procedure to assemble a billet, extrude and draw it, with intermediate and final anneals, is described. Then an hypothetical production line with potential alternative processes along the entire path from heavy billet to fine wire, is laid out. Several processes at different stages of development, are offered, with the message that their potential must be explored for the development of a more reliable product, at a more economical production cost. An analysis of core fracture and its prevention during the process of drawing is provided. Treatment of velocity fields for a bi-metallic rod leads to the determination of criteria for the prevention of fracture. The criteria are presented graphically. Finally, the micro properties of superconducting wires are examined. A modification of the bronze method for niobium-tin superconductors is proposed. DOE

N80-30571# Centre Scientifique et Technique du Batiment, Paris (France).

[RESEARCH IN BUILDING CONSTRUCTION AND MATERIALS FOR 1978] Annual Report

Sep. 1978 56 p In ENGLISH and FRENCH

(CSTB-192) Avail: NTIS HC A04/MF A01

Sociological questions, the economics of building construction, and problems relating to acoustics, lighting, colorimetry, and climatology are reviewed. Also studied are thermal requirements, structural materials, stability, and fire safety as well as building maintenance. Author (ESA)

N80-30572# Centre Scientifique et Technique du Batiment, Paris (France).

[ACTIVITIES IN THE BUILDING TRADE INDUSTRY IN 1978] Annual Report [L'ACTIVITE DU CENTRE SCIENTIFIQUE ET TECHNIQUE DU BATIMENT (CSTB) EN 1978]

Apr. 1979 361 p refs In FRENCH

(CSTB-198) Avail: NTIS HC A16/MF A01

Activities in architecture, construction techniques, economics, social sciences, meteorology, foundation technology, structural stability, fire resistance, and acoustics are outlined. Other topics include materials properties, lighting, climatology, and aerodynamics of structures. Author (ESA)

N80-30573# Polytechnic Inst. of New York.

PREDICTION OF EARTHQUAKE RESISTANCE OF STRUCTURES Final Report

Ping-Chun Wang 20 Jan. 1980 200 p refs

(Grant NSF PFR-76-14893)

(PB80-170731; NSF/RA-800013) Avail: NTIS HC A09/MF A01 CSCL 13M

Methods of predicting structural resistance to earthquakes were studied. Particular emphasis was given to developing an upper bound or critical ground excitation for a structure of major importance, so that a high level of confidence in the prediction of structural resistance may be achieved. Both linear and nonlinear structures were considered. The method was applied to several nuclear reactors. Results indicate that the method is conservative but not overly so. The responses from the critical excitation are in the range of 1.1 to 2 times those produced by recorded earthquakes of the same intensity. GRA

N80-30574# TRW Systems and Energy, Redondo Beach, Calif.

DEVELOPMENT STUDY OF A NOVEL CONTINUOUS-FLOW IMPACTOR Final Report, Jul. 1978 - Nov. 1978

E. F. Brooks, N. Gat, M. E. Taylor, T. E. Chamberlain, R. J. Golik, and R. Watson Jan. 1980 127 p refs

(Contract EPA-68-02-2165)

(PB80-179286; EPA-600/7-80-014) Avail: NTIS HC A07/MF A01 CSCL 13B

Results of a development study involving feasibility verification of a novel particle impactor in which the impaction surface is the interface between two opposing jets are given. Particles cross the interface between the aerosolladen gas and a previously particle-free gas, are entrained in the latter, and are conveyed out for analysis. Work consisted of an initial literature search and analysis, followed by design, fabrication, and testing of a laboratory unit. A good particle separation capability was demonstrated. A design effort showed the feasibility of a staged in situ particle monitoring subsystem to give semicontinuous output of particle size distribution. GRA

N80-30575# Illinois Univ., Urbana-Champaign. Dept. of Civil Engineering.

COMMONALITY OF EARTHQUAKE AND WIND ANALYSIS Ph.D. Thesis

Pedro J. Cevallos-Candau and W. J. Wall Jan. 1980 210 p refs

(Grants NSF ENV-75-08456; NSF ENV-77-07190)

(PB80-178312; UILU-ENG-80-2002; SRS-472; NSF/RA-800022) Avail: NTIS HC A10/MF A01 CSCL 13M

The common features of general dynamic analysis procedures employed for evaluating the effects of wind and earthquake excitation were investigated. A major goal was to investigate and develop a basis for generating response spectra for wind loading, which in turn would permit the use of modal analysis techniques for wind analysis in a manner similar to that employed for earthquake engineering. Random vibration techniques were applied for developing response spectra for wind loading. In order to generate wind response spectra, the wind loading is divided into two parts, a mean load treated as a static component and a fluctuating load treated as a dynamic component. The spectral representation of the wind loading constitutes a simple procedure for estimating the forces associated with the dynamic component of the gusting wind. GRA

N80-30576# Illinois Univ. at Urbana-Champaign, Urbana. Dept. of Civil Engineering.

SIMPLE AND COMPLEX MODELS FOR NONLINEAR SEISMIC RESPONSE OF REINFORCED CONCRETE STRUCTURES

Mehdi Saiidi and Mete A. Sozen Aug. 1979 194 p refs

(Grant NSF PFR-78-16318)

(PB80-182413; UILU-ENG-79-2013; SRS-465; NSF/RA-790388) Avail: NTIS HC A09/MF A01 CSCL 13M

The possibility of simplifying the nonlinear analysis of reinforced concrete structures subjected to severe earthquakes was investigated. One thrust was a microscopic study of the simple models leading to acceptable results. For this phase, a multi-degree nonlinear model was developed to analyze rectangular reinforced concrete frames for given base acceleration records, and which is capable of accepting a collection of hysteresis systems, some previously used and others developed in the course of this project. The second phase comprised a macroscopic study which included development of a simple model that resulted in a reasonably close estimate of nonlinear response. A given structure was viewed as a single degree of freedom system which recognized stiffness changes due to the nonlinearity of material. GRA

N80-30577# Portland Cement Association, Skokie, Ill.
DESIGN AND CONSTRUCTION OF LARGE-PANEL CONCRETE STRUCTURES. REPORT 6: DESIGN METHODOLOGY
Donald M. Schultz Mar. 1979 118 p refs
(Contract HUD-H-2131R)
(PB80-189137; HUD-0001431) Avail: NTIS
HC A06/MF A01 CSCL 13M

The structural integrity of large panel concrete buildings under abnormal conditions is considered with emphasis on the importance of the design strengths of large panel structures and their individual elements. Topics covered include the scope, limitations, and definitions involved in the design methodology; some general considerations of analysis and design; and minimum requirements for integrity. Foundations, floor and roof elements, walls, joints, and connections between precast members are discussed and details of handling, assembly, and erection, and special provisions for seismic and wind design are included. An appendix on site planning considerations is provided. GRA

N80-30578# National Bureau of Standards, Washington, D.C. National Engineering Lab.
THE CALIBRATION OF ANGLE BLOCKS BY INTERCOMPARISON Final Report
Charles P. Reeve Apr. 1980 27 p refs
(PB80-182132; NBSIR-80-1967) Avail: NTIS
HC A03/MF A01 CSCL 14B

The calibration of angle blocks at the National Bureau of Standards is described. Test blocks normally come in sets of 16 nominal sizes from 1 second to 45 degrees. Their angular values are calibrated by intercomparison with NBS master angle blocks and other test blocks of the same nominal size. Each test block is also measured for its maximum out-of-flatness and out-of-squareness. Statistical tests are performed in order to maintain control over the short term and long term variability of the measurement process. A complete description of the measurement process is given with special attention paid to the mathematical model for the measurements and the least squares estimation of the angular values. The method for determining the standard deviations of the short term and long term errors is also given. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also 04 Aircraft Communications and Navigation and 17 Spacecraft Communications, Command and Tracking.

N80-30579 California Inst. of Tech., Pasadena.
THE INFLUENCE OF RANDOM MEDIA ON THE PROPAGATION AND DEPOLARIZATION OF ELECTROMAGNETIC WAVES Ph.D. Thesis
Jerry Michael Harris 1980 111 p
Avail: Univ. Microfilms Order No. 8018891

A discrete model for the continuous random medium is developed by dividing the volume occupied by the inhomogeneities into independent elementary scattering volumes. Scattering by each of these elementary volumes is analyzed to obtained the complex amplitude and polarization of the single scattered field. Then multiple scattering among the many elementary volumes is used to estimate the composite values for scattering per unit length and depolarization per unit length of the medium. The manifestation of scattering in the medium is the generation of an incoherent or fluctuating electric wavefield and a coherent or average electric wavefield. It is shown that the total electrical wavefield propagating in the medium satisfies an integral equation which is directly reducible to the classical equation for radiation transfer. Two phenomenological parameters are needed to describe the penetration of the wave into a plane-parallel medium, when a polarized plane wave is normally incident. These parameters appear as diffusion constants in expression for the solution for the coherency and Stokes matrices. These solutions describe how wave energy is progressively converted from the initially coherent and polarized field to an incoherent and unpolarized field as the wave propagates. Dissert. Abstr.

N80-30580 California Univ., Irvine.
A SEARCH FOR ADVANCED FIELDS IN ELECTROMAGNETIC RADIATION Ph.D. Thesis
Jeffrey David Schmidt 1980 209 p
Avail: Univ. Microfilms Order No. 8019697

An experiment to search for an advanced component of electromagnetic radiation, as suggested by the time symmetry of Maxwell's equations was conducted. A dipole transmitting antenna was driven periodically with 10.2 GHz microwave pulses of 12 ns duration and 4 watt instantaneous power. A receiving dipole antenna at a distance R = 10m away was instrumented to search for power above noise received in a time gate at a time r/c prior to transmission of each pulse. Data were integrated over 10 to the 7th power pulses. The experiment was performed at Lick Observatory, atop Mt. Hamilton, CA, to enable placement of the antennas so that a line connecting them, when extended to infinity in both directions, encounters no local complete absorber. Defining R to be the ratio of signal power in the advanced time gate to power received in a corresponding retarded gate at time r/c after pulse transmission, a limit is obtained: R < 10 to the -11.5th power. Runs were also made using dielectric microwave lenses placed to focus an advanced radiation component, yielding a more theory dependent result: R > 10 to the 14th power. Dissert. Abstr.

N80-30581 Dartmouth Coll., Hanover, N.H.
CERENKOV RADIATION IN DIELECTRIC-LOADED WAVEGUIDES Ph.D. Thesis
Kevin Lee Felch 1980 224 p
Avail: Univ. Microfilms Order No. 8019066

The use of Cerenkov radiation as a source of high frequency, high power microwave radiation is dealt with in detail. Using the Cerenkov interaction, when a relativistic electron beam is passed down the center of a dielectric-lined waveguide, microwave radiation at frequencies in excess of 150 GHz and power levels of about 1 W were produced. In addition, microwave radiation with approximately 1 kW of peak power at frequencies between 20 GHz and 35 GHz were observed. These results and a theoretical model serve to explain many of the experimental observations and the basic scaling of such a Cerenkov microwave generator. By the proper manipulation of the various parameters of the experiment it is shown theoretically how a Cerenkov generator might be scaled in such a way as to be a viable source of high power, submillimeter radiation. Finally, specific methods which may be applied to the present experimental efforts in order to investigate the various ways in which higher output frequencies and powers may be obtained. Dissert. Abstr.

N80-30582 Pennsylvania Univ., Philadelphia.
EDGE EFFECTS IN LOW SIDELOBE ARRAY ANTENNAS Ph.D. Thesis
Leonard Howard Yorinks 1980 159 p
Avail: Univ. Microfilms Order No. 8018630

The influence of the edge effects, which fall in the category of systematic errors, on the sidelobe performance of a very low sidelobe antenna was examined. This was accomplished by examining the problem of an infinite linear parallel plate array with strip blockage. The analysis was performed by deriving a Fredholm integral equation of the first kind for the electric field in the array aperture. The integral equation was subsequently solved using the moment method to obtain the aperture field.

the reflection coefficients, and the radiation patterns, or element factors, of each the elements. Solutions were obtained for waveguide arrays excided with both TE wave and TEM waves. An efficient method of computing the element factors of the elements in either the special array under study or in a uniform array was introduced. The contribution of edge effect to antenna sidelobes was quantified by introducing the element factor error function. By examining the upper bound on the sidelobe contribution due to edge effects, it was shown that the antenna size has a lower bound below which the edge effect sidelobe contribution may not be neglected. Dissert. Abstr.

N80-30583 Drexel Univ., Philadelphia, Pa.
PROPAGATION IN A DIELECTRIC WAVEGUIDE USING THE GREEN'S FUNCTION METHOD Ph.D. Thesis
Louis Anthony Pitale 1980 75 p
Avail: Univ. Microfilms Order No. 8019354

The Green's function response of a two dimensional linear, homogeneous, isotropic, lossless, planar dielectric waveguide to an elemental electric current source is described. The source is located within the waveguide transverse to the direction of propagation. Solutions are found by first considering the associated one dimensional transverse transmission line problem. A field point is chosen at different points within the waveguide showing the field distribution in terms of the various singularities of the asymptotic form of the Green's function. Extensions to the Hertz potential and to electric and magnetic fields are shown. Responses to longitudinal electric current sources and transverse and longitudinal magnetic current sources are also indicated. Applications to transverse deterministic and stochastic inhomogeneous waveguide media and the dyadic Green's function construction is noted. Dissert. Abstr.

N80-30584 Virginia Polytechnic Inst. and State Univ., Blacksburg.
CW AND PULSED BEAM PROPAGATION IN FOCUSING MEDIA WITH RANDOM-AXIS MISALIGNMENTS Ph.D. Thesis
Stelios John Patsiokas 1979 119 p
Avail: Univ. Microfilms Order No. 8020223

A statistical technique which allows the asymptotic evaluation of second- and higher-order statistical observables related to the stochastic complex parabolic equation, without having first to derive equations for second- or higher-order coherence functions was applied to the problem of CW and pulsed beam propagation in a focusing medium characterized by random-axis misalignments. Particular emphasis is placed on the computation of second- and fourth-order physical observables (e.g., the spreading of the mean CW intensity, the variance of on- and off-axis intensity fluctuations, etc., as well as the on-axis ensemble-averaged pulse intensity). Dissert. Abstr.

N80-30585 Polytechnic Inst. of New York.
ON THE EXTRAPOLATION OF BAND-LIMITED SIGNALS Ph.D. Thesis
Christodoulos C. Chamzas 1980 210 p
Avail: Univ. Microfilms Order No. 8019391

The determination of the Fourier Transform of a band-limited signal in terms of a finite segment is examined. The Papoulis' Extrapolation Algorithm is extended in a broader class of signals and its convergence is considerably improved by a multiplication with an adaptive constant, chosen to minimize the mean square error in the extrapolation interval. The discrete version of the iteration is examined and then modified in order to converge to the best linear mean square estimator of the unknown signal when noise is added to the given data. The problem of determining the frequencies, amplitudes and phases of a sinusoidal signal from incomplete noisy data, is considered and the extrapolation algorithm is properly modified to estimate these quantities. The obtained iteration is nonlinear and adaptively reduces the spectral components due to noise. The adaptive extrapolation technique is applied to the problem of image restoration for objects consisting of point or line sources, and to an ultrasonic problem. Dissert. Abstr.

N80-30586 Cincinnati Univ., Ohio.
THE PROPAGATION OF ELASTIC WAVES IN HETEROGENEOUS MEDIA Ph.D. Thesis
James S. Kelm 1980 152 p
Avail: Univ. Microfilms Order No. 8021073

Approximate solutions are presented for the case of general properties in the media. Solutions are developed for a transformed canonical form of the well known wave equation, referred to as the Klein-Gordon form. These approximate solutions use as a basis, the constant coefficient exact solution in their development. Solutions restricted to the wavefront (or arrival time) and far field time domains are developed. Also, a solution is developed for slowly varying coefficients of the Klein-Gordon equation. This solution provides an accurate representation of wave propagation throughout the time domain. The solution is particularly useful in predicting transient pulse propagation and the ensuing local tailing or reflection of the wave in media with rapidly varying properties. The solution techniques presented complement and extend the work available in the literature. These techniques provide greater insight to the problem of elastic wave propagation in heterogeneous media and can be applied in a reasonably simple manner. Dissert. Abstr.

N80-30587*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A STUDY OF A SPACE COMMUNICATION SYSTEM FOR THE CONTROL AND MONITORING OF THE ELECTRIC DISTRIBUTION SYSTEM. VOLUME 2: SUPPORTING DATA AND ANALYSES
A. Vaisnys May 1980 270 p refs
(Contracts NAS7-100; DE-AI01-79ET-29372)
(NASA-CR-163478; JPL-Pub-80-48-Vol-2) Avail: NTIS HC A12/MF A01 CSCL 17B

It is technically feasible to design a satellite communication system to serve the United States electric utility industry's needs relative to load management, real-time operations management, remote meter reading and to determine the costs of various elements of the system. The functions associated with distribution automation and control and communication system requirements are defined. Factors related to formulating viable communication concepts, the relationship of various design factors to utility operating practices, and the results of the cost analysis are discussed. The system concept and several ways in which the concept could be integrated into the utility industry are described. R.K.G.

N80-30588*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
GENERATION AND INJECTION OF E.M. WAVES IN SPACE PLASMA BY MEANS OF A LONG ORBITING TETHER Semiannual Progress Report, 11 Dec. 1979 - 10 Jun. 1980
Jul. 1980 44 p refs
(Contract NAS8-33520)
(NASA-CR-161533; SAPR-1) Avail: NTIS HC A03/MF A01 CSCL 20N

The generation and injection of electromagnetic waves in space plasma by means of a long orbiting tether are considered. The objectives include an estimation of the portions of the primary electrodynamic power developed by the tether that goes to excite each of various wave generation and injection mechanisms expected to be present during a tether's orbital flight, an evaluation of the signal levels associated with each one of the mechanisms above, and verification of their detectability with state-of-the-art instrumentation on the Earth surface or elsewhere. The generation and injection of Alfven waves and electron whistler waves were identified as the most relevant mechanisms activited by the electrodynamic tether. The physical mechanisms that govern these two families of phenomena were investigated and the ratio between the power that goes in Alfven waves and in whistlers was derived. The analysis of the possible production of accelerated electrons by the electrodynamic tether was initiated. E.D.K.

N80-30589# Stanford Univ., Calif. Computer Systems Lab.
DISTRIBUTION OF PACKET DELAY AND INTERDEPARTURE TIME IN CARRIER SENSE MULTIPLE ACCESS
Fouad A. Tobagi 1 Apr. 1980 37 p refs
(Contract DAAG29-79-C-0138)
(AD-A086446; TR-187; ARO-16783.1-A-EL) Avail: NTIS HC A03/MF A01 CSCL 17/2

Existing analysis of the carrier sense multiple access mode (CSMA) has led to the determination of the average channel performance in terms of average throughput and average packet

delay. This was achieved by formulating a semi-Markovian model for CSMA channels with a finite population of users. In this paper, it is shown that, using the same model, it is possible to derive the actual packet delay distribution. The analysis is similar in nature to that provided for slotted ALOHA channels. These results are useful in the design of systems intended for real time applications such as digitized speech, and in the analysis of multihop packet radio systems. GRA

N80-30590# Ohio State Univ., Columbus. ElectroScience Lab.
PATTERN ANALYSIS OF A HORN ANTENNA IN THE PRESENCE OF OBSTACLES
W. D. Burnside and C. S. Kim Feb. 1980 44 p refs
(Contract N62269-78-C-0379; W06380000)
(AD-A086426; ESL-711588-1; NADC-80095-30) Avail: NTIS HC A03/MF A01 CSCL 20/14

It is suggested that the geometrical theory of diffraction (GTD) can be applied to problems in which the single antenna considered previously is replaced by a large array. It is demonstrated that GTD can successfully predict the low scattering associated with a pattern slide lobe hitting a plate or set of plates. In that it is not pertinent what created the low side lobe which intersects the plate, a rectangular horn is used as the source in that it is much simpler to control experimentally. Based on many comparisons between calculated and measured results, it appears that GTD can accurately predict these low scattering levels, i.e., especially accurate for at least the first 20 dB below the maximum plate illumination level. E.D.K.

N80-30591# Ohio State Univ., Columbus. ElectroScience Lab.
AIRBORNE ANTENNA PATTERN CODE USER'S MANUAL
W. D. Burnside and T. Chu Mar. 1980 106 p refs
(Contracts N62269-78-C-0379; F30602-79-C-0068; W06380000)
(AD-A086331; ESL-711588-2; NADC-80096-30) Avail: NTIS HC A06/MF A01 CSCL 20/14

This report describes the use of a computer code to analyze antenna mounted on aircraft fuselage. Ramjet configurations can be handled as a special case by this code. The pattern can be taken in terms of an arbitrary conical cut. The organization of the code, definition of input and output data, multiple finite plate approach to simulate the structures on aircraft and various examples are presented. The analysis is based on the geometrical theory of diffraction, and various computed patterns are compared with experimental results. GRA

N80-30592# Naval Underwater Systems Center, Newport R. I. Submarine Electromagnetic Systems Dept.
THE MAGNETIC CHARACTERISTICS OF TAPE WRAPPED CYLINDRICAL FERROMAGNETIC LAMINATIONS FOR FREQUENCIES BELOW 50 KHZ
Louis J. Dalsass 22 Feb. 1980 19 p refs
(AD-A086333; NUSC-TM-791227) Avail: NTIS HC A02/MF A01 CSCL 09/3

The leakage magnetic fields from magnetic devices are known to create EMI problems for sensitive shipboard VLF receivers and sonar equipment. Devices which contain ferromagnetic cores can be particularly significant EMI offenders because of the high flux densities available in their magnetic circuits. This memorandum discusses the magnetic characteristics of various laminated cores found in shipboard equipment (with source frequencies extending into the VLF band). Test results are presented for an open tape cylindrical lamination containing an axial and radial air gap. Although this is a more complicated magnetic circuit, its behavior is shown to be identical to predictions derived for simple lamination shapes without air gaps for frequencies up to 50 kHz. GRA

N80-30593# Naval Research Lab., Washington, D. C.
SURVEY OF POTENTIAL RADIO FREQUENCY INTERFERENCE SOURCES Final Report
C. David Crandall 13 May 1980 210 p
(WO5270S00)
(AD-A086785; AD-E000465; NRL-MR-4200) Avail: NTIS HC A10/MF A01 CSCL 17/9

This report is a survey of the potential Radio Frequency Interference (RFI) sources that are currently affecting the analysis of data from the Seasat Scanning Multichannel Microwave Radiometer (SMMR) and those sources that could affect the design of the Large Antenna Multichannel Microwave Radiometer (LAMMR) for the National Oceanic Satellite System (NOSS). The Seasat SMMR survey is limited to the 6.5 to 6.7 GHz channel and to emitters on the West Coast of the United States and Canada where RFI has been encountered. The NOSS LAMMR survey covers all of the potential frequencies of interest; 3.0 to 7.6 GHz, 10.5 to 11.0 GHz, 13.4 to 14.0 GHz, 14.5 to 14.7 GHz, 17.0 to 18.8 GHz, 20.8 to 22.4 GHz, 34.0 to 35.5 GHz, 36.0 to 37.0 GHz, 76.0 to 77.0 GHz, and 88.0 to 94.0 GHz. Also included are excerpts from the current international frequency allocation tables and excerpts from the U.S. position which was presented at the 1979 World Administration Radio Conference (WARC). GRA

N80-30594# Naval Research Lab., Washington, D. C. Systems Integration and Instrumentation Branch.
SYNTHESIS OF MCJ CODES Interim Report
Hugo M. Beck 4 Apr. 1980 21 p refs
(AD-A086778; AD-E000444; NRL-8393) Avail: NTIS HC A02/MF A01 CSCL 09/4

Constructive techniques are given for the encoding and decoding of Massey-Costello-Justesen (MCJ) error control block codes. These codes form a family of maximum distance separable (MDS) codes distinct from the Reed-Solomon (RS) codes. The MCJ codes offer ease of encoding and decoding for either hardware or software implementations, based on the more natural Galois ground field mathematical operations involved in the associated algorithms. Because of inherent burst error control capabilities, these codes can be considered for channel error protection as well as for end-to-end message error control. GRA

N80-30595# Naval Research Lab., Washington, D. C. Target Characteristics Branch.
A NEW CLASS OF PULSE COMPRESSION CODES AND TECHNIQUES Interim Report
B. L. Lewis and F. F. Kretschmer 26 Mar. 1980 26 p refs
(SF12141491)
(AD-A086787; AD-E000442; NRL-8387) Avail: NTIS HC A03/MF A01 CSCL 17/9

A new class of symmetrical polyphase codes is introduced that promises to be very useful in pulse expander-compressor circuits for radar systems. These codes are very compatible with digital signal processing techniques. The code symmetry permits digital pulse expander-compressors to be implemented with less hardware than required with any previously known code. Another significant advantage of the new codes is that precompression bandwidth limiting such as normally would be found in any well-designed radar actually improves the mainlobe to sidelobe ratios obtainable with the new codes while it degrades that obtainable with the previously known Frank code. GRA

N80-30596# Naval Research Lab., Washington, D. C.
PRELIMINARY RESULTS OF RADAR ENVIRONMENTAL MAPPING Interim Report
B. H. Cantrell 28 Apr. 1980 21 p refs
(RR0210541)
(AD-A086788; AD-E000440; NRL-8400) Avail: NTIS HC A02/MF A01 CSCL 17/9

The signals received by radars often contain much more information than the echoes from targets, but usually only the target echoes are extracted. Means of extracting the environmental conditions such as rain and land clutter, noise jamming, short-pulse interference, and thermal-noise regions are studied. The knowledge of the environmental conditions is thought to be useful in target tracking and radar control processes. GRA

N80-30597# Dikewood Industries, Inc., Albuquerque, N. Mex.
INTERACTION BETWEEN A PARALLEL-PLATE EMP SIMULATOR AND A CYLINDRICAL TEST OBJECT Final Report
J. Lam Kirtland AFB, N. Mex. AFWL May 1980 41 p refs
(Contract F29601-78-C-0045; AF Proj. 3763)
(AD-A086815; AD-E200519; DC-FR-1299-3; AFWL-TR-79-138) Avail: NTIS HC A03/MF A01 CSCL 20/14

The interaction between a bounded-wave EMP simulator and a test object is studied with a geometrical model. The model consists of a finite, open-ended cylinder inside a parallel-plate waveguide. The interaction problem is formulated exactly by means of an integrodifferential equation, which is subsequently reduced to a matrix equation. An approximate analytical solution of the matrix equation is obtained. The singularities of the solution in the complex-frequency plane are investigated. The effects of the simulator/test-object interaction on the pole singularities are numerically evaluated. GRA

N80-30598# Dikewood Industries, Inc., Albuquerque, N. Mex.
DISCRETE AND CONTINUOUS SPECTRA OF FINITE-WIDTH, PARALLEL-PLATE SIMULATOR FIELDS Final Report
F. C. Yang Kirtland AFB, N. Mex. AFWL May 1980 108 p refs
(Contract F29601-78-C-0045; AF Proj. 3763)
(AD-A086813; AD-E200518; DC-FR-1299-2; AFWL-TR-79-137) Avail: NTIS HC A06/MF A01 CSCL 20/14

The discrete (referred as modes) and continuous spectra of finite-width, parallel-plate simulator fields are investigated. Formulas suitable for numerical calculation are obtained for both the transverse-magnetic (TM) and transverse-electric (TE) fields. Numerical results for the propagation constants and the field distributions of the higher order TM modes are presented. It is found that in the working volume of the parallel-plate simulator some of the higher-order TM modes resemble those of a closed waveguide, and the field of the continuous spectrum decays at least as z^{-2} for waves propagating along the z-direction. GRA

N80-30599# Dikewood Industries, Inc., Albuquerque, N. Mex.
PARALLEL-PLATE TRANSMISSION LINE TYPE OF EMP SIMULATORS: SYSTEMATIC REVIEW AND RECOMMENDATIONS Final Report
D. V. Giri, T. K. Liu, F. M. Tesche (LuTech, Inc., Albuquerque, N. Mex.), and R. W. P. King (Harvard Univ.) Kirtland AFB, N.Mex. AFWL May 1980 169 p refs
(Contract F29601-78-C-0045; AF Proj. 3763)
(AD-A086814; AD-E200520; DC-FR-1299-4) Avail: NTIS HC A08/MF A01 CSCL 20/14

This report presents various aspects of the two-parallel-plate transmission line type of EMP simulator. Much of the work is the result of research efforts conducted during the last two decades at the Air Force Weapons Laboratory, and in industries/universities as well. The principal features of individual simulator components are discussed. The report also emphasizes that it is imperative to hybridize our understanding of individual components so that we can draw meaningful conclusions of simulator performance as a whole. GRA

N80-30600# Dikewood Industries, Inc., Albuquerque, N. Mex.
EXCITATION OF THE PARALLEL-PLATE SECTION OF A BOUNDED WAVE EMP SIMULATOR BY A CONICAL TRANSMISSION LINE Final Report
J. Lam Kirtland AFB, N. Mex. AFWL May 1980 55 p refs
(Contract F29601-78-C-0045)
(AD-A086812; AD-E200517; DC-FR-1299-1; AFWL-TR-79-136) Avail: NTIS HC A04/MF A01 CSCL 20/14

The excitation of a parallel-plate electromagnetic pulse (EMP) simulator by an electromagnetic pulse via a conical transmission line is analyzed. The analysis first establishes an exact formulation of the problem by use of the technique of electric-field integrodifferential equations. It then goes over to a simpler, approximate formulation in the form of an integrodifferential equation for the total longitudinal surface current flowing on the simulator. This equation is further transformed into an integral equation, and the model structure of its solution investigated. A self-consistent method for solving the integral equation is developed. An analytical formula for the current in the transverse-electromagnetic (TEM) mode is thereby obtained. The analysis concludes with a numerical study of the TEM current and its variation with the parameters of the simulator geometry. GRA

N80-30601# Syracuse Univ., N. Y.
EXPERIMENTAL VALIDATION OF THE ANTENNA PATTERN DISTORTION COMPUTER PROGRAM: DISTORT (UHF ANTENNAS) Technical Report, Apr. - Nov. 1978
Jose Perini and Hubert Moses Scott AFB, Ill. Air Force Communications Command 30 Apr. 1980 93 p
(Contract F30602-75-C-0121)
(AD-A086330; RADC-TR-80-8; EEG-TR-80-5) Avail: NTIS HC A05/MF A01 CSCL 09/5

This report describes the procedures and the experimental measurements carried out to validate the Antenna Pattern Distortion Computer Program (DISTORT) for the AT-197/GR and AS-1097/GR UHF antennas. The report also covers the validation of the reflection coefficient formulation for imperfect Earth. GRA

N80-30602# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
RADIO RECEIVER, SPURIOUS RESPONSE, TEST OPERATIONS PROCEDURE Final Report
12 May 1980 15 p
(AD-A086463; TOP-6-2-545) Avail: NTIS HC A02/MF A01 CSCL 17/2

This TOP determines and measures the spurious responses of AM/FM radio receivers by using commonly available test instrumentation. It has general applicability to all receivers, including image, intermediate frequency (IF) feed-through, local oscillator related, and extraneously produced spurious responses. Spurious responses are signals propagated at frequencies outside of the tuned principal response frequency to which the receiver responds with measurable output power. They reveal frequencies where the receiver is most susceptible to undesired signals (jamming). GRA

N80-30603# Parke Mathematical Labs., Inc., Carlisle, Mass.
SPECTRAL ANALYSIS OF SCINTILLATION DATA TAKEN FROM AN AIRCRAFT, PART 1 Final Report, Oct. 1976 - Oct. 1979
Theodore B. Barrett Hanscom AFB, Mass. AFGL Feb. 1980 83 p refs
(Contract F19628-76-C-0296; AF Proj. 7663)
(AD-A086837; AFGL-TR-80-0055-Pt-1; Rept-0296-1) Avail: NTIS CSCL 20/14

This report provides theoretical background material for the development of a thin phase screen model for radio scintillation. This model is then used to derive an expression for the expected amplitude scintillation spectra (spectral density funciton) which might be observed in a geometry which includes a satellite based transmitter, an aircraft based receiver and a thin, intermediate scintillation-producing medium. A computer procedure was developed for testing the model under various geometries and for various parameters describing the bulk properties statistical properties of the medium. In addition to the development of a theoretical model, this report includes material on experimental spectral analysis and, in particular, details on a spectral analysis procedure which was used on amplitude scintillation and data gathered from an aircraft in geomagnetic equatorial regions. GRA

N80-30604# Polytechnic Inst. of New York, Brooklyn.
WAVE PROPAGATION IN HONEYCOMB AND FOAM-CORE PANELS FOR APPLICATION TO PANEL NDE Final Technical Report, 1 Jul. 1977 - 11 Oct. 1979
Henry L. Bertoni and S. K. Park Griffiss AFB, N.Y. RADC Apr. 1980 141 p refs
(Contract F19628-77-C-0130; AF Proj. 2305)
(AD-A086667; RADC-TR-80-112) Avail: NTIS HC A07/MF A01 CSCL 13/13

For rapid inspection, it is most useful to consider acoustic waves traveling along the larger dimensions of the panels. A study was made of the waves propagating in the honeycomb itself, particularly in the frequency range where the wavelength is on the order of the cell diameter. The characteristics of Bloch waves propagating in a honeycomb of infinite extent were calculated. At low frequencies, the honeycomb was found to act as an elastic continuum. At high frequencies, the periodicity and anisotropy of the honeycomb affect the propagation of the Bloch waves, and result in the presence of stop bands for propagation in certain directions. Computations of the frequency dependence, direction dependence, and polarization of the Bloch waves were made. In addition, the propagation characteristics

of the waves guided by an aluminum face plate bonded to a honeycomb of semi-finite extent were studied in the low frequency range where the honeycomb acts as an elastic absorber. It was found that the presence of the honeycomb strongly perturbs the waves guided by the face plate, so that one can expect to inspect for de-bonded regions by measuring propagation characteristics. Similar results were found for a foam core bonded to an aluminum face plate. In this case, a glue layer bonding face plate to the foam was also considered and found to have a significant effect on the guided waves. GRA

N80-30606# Georgia Inst. of Tech., Atlanta. Electronic Technology Lab.
ADAPTIVE TIME DELAY CIRCUITRY FOR INTERFERENCE CANCELLATION SYSTEMS Final Technical Report, 30 Oct. 1978 - 31 Oct. 1979
Donald E. Clark and William A. Hardell Griffiss AFB, N.Y. RADC Apr. 1980 58 p refs
(Contract F30602-78-C-0120; AF Proj. 2338)
(AD-A086326; GIT-A-2287(FI)) Avail: NTIS HC A04/MF A01 CSCL 09/1

The objective of this research program was to study and investigate variable time delay techniques for use in interference cancellation systems so as to improve their performance. A comprehensive survey of past research pertaining to HF, VHF, and UHF variable time delay techniques was undertaken. The survey also included microwave variable time delay techniques that are adaptable to the lower bands. As part of this program, variable delay lines were constructed and experimental measurements performed. Specifically, two types of delay lines were investigated, one using a coaxial transmission section with a helix surrounding a ferrite rod and the other a powdered ferrite and dielectric loaded coaxial section. The report presents experimental results over the HF, VHF, and UHF bands. GRA

N80-30606# Naval Postgraduate School, Monterey, Calif.
MODELING OF PULSES HAVING ARBITRARY AMPLITUDE AND FREQUENCY MODULATION Ph.D. Thesis
Francis Martin Lunney Mar. 1980 150 p refs
(AD-A086567) Avail: NTIS HC A07/MF A01 CSCL 09/4

A model is developed which provides for the generation of the approximate spectra of pulsed signals with arbitrary amplitude and frequency modulation. Error bounds associated with the model are developed providing an insight into performance accuracy. The concept of using two approximate spectra to generate a more exact spectrum by means of computationally trivial calculations is addressed. The model is used to validate the feasibility of using frequency domain discriminants in the signal classification process. GRA

N80-30607# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
BOUNDS ON THE UTILIZATION OF ALOHA-LIKE MULTIPLE-ACCESS BROADCAST CHANNELS
Pierre A. Humblet Jun. 1980 16 p refs
(Contract N00014-75-C-1183; Grant NSF ENG-77-19971; ARPA Order 3045)
(AD-A086655; LIDS-P-1000) Avail: NTIS HC A02/MF A01 CSCL 17/2

Pippenger's model for synchronous protocols that resolve conflicts among message transmissions on a multiple-access broadcast channel is extended to the case where the transmission times depend on the outcome of the transmissions. An information theoretic method is used to provide new bounds on the utilization of the channel. GRA

N80-30608# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
A CONFLICT RESOLUTION ALGORITHM FOR NOISY MULTIACCESS CHANNELS B.S. Thesis
David Mark Ryter Jun. 1980 76 p refs
(Contract N00014-75-C-1183; ARPA Order 3045)
(AD-A086767; LIDS-TH-1007) Avail: NTIS HC A05/MF A01 CSCL 17/2

An efficient contention resolution scheme has been developed by Gallager to be used in allocating usage of common channel to a large number of independent transmitters. Time is divided into equal size intervals called slots. Message transmissions begin only at slot boundaries and do not overlap boundaries. Depending on the channel history, as monitored by the users, the algorithm defines a system-wide 'transmission interval' at the beginning of each slot. A user can only transmit when it possesses a message with a generation time falling at the current transmission interval. This algorithm is modelled as a Markov process. The Gallager algorithm is based on the assumption that the transmitters make no errors in the detection of channel activity. This thesis investigates the case where a limited class of detection errors is introduced into the system. A modified algorithm is proposed to effectively correct these errors. This Noisy Channel Algorithm includes a stack mechanism and two special processing states. The algorithm is again modelled as a Markov process and retains some key features of the Gallager algorithm. The algorithm is analyzed and the degree to which system performance is downgraded by errors is determined. GRA

N80-30609# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A PREDICTOR MODEL FOR SHF AND EHF MILSATCOM SYSTEM AVAILABILITIES IN THE PRESENCE OF RAIN
Leonard M. Schwab 21 Feb. 1980 104 p refs
(Contract F19628-80-C-0002)
(AD-A086714; TN-1980-15) Avail: NTIS HC A06/MF A01 CSCL 20/14

A numerical method for computing MILSATCOM system availability based on predicted link availability is described. Link availability can be computed in the model for frequencies of 10-50 GHz, arbitrary geostationary satellite subpoint, and arbitrary value of link margin in dB. Computed availability contours are plotted on a Mercator grid of the world. GRA

N80-30610# Kansas Univ. Center for Research, Inc., Lawrence.
ANALYTICAL STUDY OF THE BISTATIC RADAR CROSS-SECTION OF A PROLATE SPHEROID Final Report, 1 May 1979 - 1 Feb. 1980
Albert W. Biggs and Stanton B. McMillian Mar. 1980 37 p refs
(Grant AF-AFOSR-0105-79; AF Proj. 2305)
(AD-A086846; AFOSR-80-0532TR) Avail: NTIS HC A03/MF A01 CSCL 17/9

Bistatic radar has important application in strategic and tactical space surveillance and in weapon tracking. At the present time, there is a lack of standard techniques for measuring radar cross sections. This effort was a feasibility study into obtaining an exact radar cross section for the Advanced Strategic Air Launched Missile (ASALM). The study was limited to the bistatic cross section of a typical target. A prolate spheroid was selected because it resembles an air cruise missile. Results were configured in the form of bistatic cross sections with a computer program to generate additional cross sections for prolate spheroids with different major to minor axis ratios. Any surface that is convex at each point, and which has no two distinct points where the outward normal vectors are in the same direction, can be handled similarly. Hence, the program written could very quickly be changed to handle a figure that is ellipsoidal in all the major planes, or even a parabola of revolution that extends to infinity in one direction. It is simple a matter of being able mathematically to describe the surface. GRA

N80-30611# Johns Hopkins Univ., Baltimore, Md. Dept. of Psychology.
THE HUMAN USE OF TELECOMMUNICATION SYSTEMS Final Report, 1 Oct. 1974 - 30 Jun. 1980
Alphonse Chapanis Jun. 1980 25 p refs
(Contract N00014-75-C-0131; NR Proj. 196-135)
(AD-A086745) Avail: NTIS HC A02/MF A01 CSCL 05/10

This report summarizes a series of studies in a research program dealing with interactive communication, conferencing and teleconferencing. The studies fall into three broad classes: (1) a naturalistic study of real conferences in academic, business, and government settings; (2) several laboratory experiments investigating human and system variables in telecommunications; and (3) studies relating to language and language usage in interactive communication and telecommunication. The principal findings of the studies are summarized and integrated and implications are drawn for the design of telecommunication systems. GRA

N80-30612# Johns Hopkins Univ., Baltimore, Md. Dept. of Psychology.
COMMUNICATION CONTROL AND LEADERSHIP IN TELECOMMUNICATIONS BY SMALL GROUPS
Peter D. Pagerey Jun. 1980 125 p refs
(Contract N00014-75-C-0131; NR Proj. 196-135)
(AD-A086746; TR-10) Avail: NTIS HC A06/MF A01 CSCL 05/10

This experiment examined the effect of communication control on the telecommunications of four subject problem solving groups, and on the emergence of leaders within the groups. Sixteen four-subject teams solved four realistic problems, one on each of four days, by communicating over a closed-circuit television system with an added audio capacity. Teams were assigned to communication systems which either did or did not have centrally controlled switching so that only one person could talk at a time, and to systems in which either (1) one subject was appointed to perform some of the experimenter's tasks or (2) no group member was so designated. Four degrees of control over communication thus ranged from no control (communication was not centrally switched, no appointed helper) to absolute control (appointed helper who switched the communication). The subject who switched the communication and/or helped the experimenter was chosen at random by the experimenter prior to the start of the first experimental session and remained the same throughout the remaining sessions. Teams were paid a bonus of up to $2.60 for each problem solution. The size of a team's bonus depended on how well the team solved each problem as determined by comparing their solutions with criterion solutions. Dependent measures include the time to solution, a measure of the quality of solution based on the size of the bonus, measures of verbal communication, and questionnaire responses. GRA

N80-30613# California Univ., Los Angeles. School of Engineering and Applied Science.
COLLISION-RESOLUTION ALGORITHMS AND RANDOM-ACCESS COMMUNICATIONS Interim Report
James L. Massey Apr. 1980 80 p refs Submitted for publication
(Contract N00014-78-C-0778)
(AD-A086695; UCLA-ENG-8016) Avail: NTIS HC A05/MF A01 CSCL 17/2

The problem considered is the random-accessing by very many transmitters of a common receiver over a time-slotted collision-type channel with feedback. A collision-resolution algorithm (CRA) is a protocol for the transmission and retransmission of packets such that, after a collision, all transmitters eventually and simultaneously learn that all the colliding packets have been successfully retransmitted. Focus is placed on a CRA due to Capetanakis (the CCRA) and a slight modification thereof (the MCCRA). The fundamental traffic-independent properties of the CCRA and MCCRA are derived by means of a recursive analysis, with emphasis on the mean and variance of the number of slots required to resolve a collision among N packets. These results are then used to analyze by a Markovian approach the performance of various random-access algorithms, built upon the CCRA and MCCRA, for the case of infinitely many identical sources generating Poisson traffic. The maximum stable throughput is determined for each random-access algorithm, and tight upper and lower bounds are developed for the delay-throughput characteristic of the 'obvious' random-access algorithm built upon the CCRA. GRA

N80-30614# Aerospace Corp., El Segundo, Calif. Electronics Research Lab.
THEORETICAL ANTENNA ANALYSIS Interim Report
H. E. King, Robert B. Dybdal, and Dorothy S. Chang 1 Jul. 1980 23 p refs
(Contract F04701-79-C-0080)
(AD-A086703; TR-0080(5930-06)-1; SD-TR-80-50) Avail: NTIS HC A02/MF A01 CSCL 20/14

The results of the analytical work for the Antennas task of the FY 1979 Mission-Oriented Investigation and Experimentation (MOIE) program are summarized. The radiation pattern computation of a 46.8 lambda diameter paraboloidal reflector antenna is compared with experimental results. The pattern analysis accounts for the feed blockage and feed-strut scatter. Good agreement between the theoretical and experimental results exists for wide-angle sidelobes. The diffraction levels from a half-plane edge and a rounded edge were computed, and good correlation with experimental results is indicated. The radiation patterns of a monopole mounted on a circular and a rectangular ground plane were also computed. GRA

N80-30615# Kentucky Univ., Lexington. Dept. of Electrical Engineering.
AN EXPERIMENTAL INVESTIGATION OF THE KING SURFACE CURRENT PROBING TECHNIQUE IN A TRANSIENT APPLICATION Electromagnetics Research Report, 1 Jan. 1978 - 1 Dec. 1979
L. Wilson Pearson and Youn M. Lee Dec. 1979 90 p refs
(Contract N00014-77-C-0362)
(AD-A087203; RR-79-4) Avail: NTIS HC A05/MF A01 CSCL 20/3

An experimental technique to measure transient surface currents of a scatterer using a King-type semicircular miniature probe is reported. The principal extension of the King technique is the use of the loop probe in transient currents measurement. The transient characteristics of the probe are considered based on the Whiteside theory (29) for the loop. The probes fabricated were subjected to transient excitation in a coaxial calibration jig. Their frequency responses were determined by Fourier transforming their output and deconvolving the excitation spectrum. The agreement between the measured results and the Whiteside theory is observed and evaluated. The probe geometry was tested in an application context, namely, the probing of current on a cylindrical scatterer. The induced surface currents were measured using the probe along the scatterer, and deconvolution of the probe transfer function was carried out subsequently. The deconvolved waveforms are reported and the results of numerical predictions by way of a time domain integral equation technique are reported for comparison. The application goal for this work lies in the numerical extraction of the Singularity Expansion Method (SEM) description of scattering from a given object, using measured transient data. GRA

N80-30616# Pacific-Sierra Research Corp., Santa Monica, Calif.
MULTIPLE SCATTERING IN CLOUDS
A. P. Ciervo Sep. 1979 78 p refs
(Contract N00014-78-C-0751; DARPA Order 8650; RT21222801)
(AD-A087043; PSR-923) Avail: NTIS HC A05/MF A01 CSCL 20/6

This report develops an analytic model for the propagation of an optical pulse through a multiple scattering medium. Such a model is needed to investigate the effect of clouds on optical communications from a satellite to a submarine. A key initial result is the derivation of simple expressions for the first two spatial and angular moments of the radiance distribution for a narrow delta-function source immersed in an infinite scattering medium. The moments support a diffusion approximation for the transport process in an infinite plane-parallel cloud. First the radiance is calculated at the cloud exit and on a plane an arbitrary distance below the cloud, then power collected by a finite receiver located on this plane is computed. The model is validated by comparing its results with computer simulation curve fits for optically thick clouds (i.e., tau = 15). The model is capable of duplicating nearly all the simulation results but at significantly lower cost. Furthermore, detailed calculations impractical to simulate are readily computed. GRA

N80-30617# Columbia Univ., New York. Radiation Lab.
RESEARCH INVESTIGATION DIRECTED TOWARD EXTENDING THE USEFUL RANGE OF THE ELECTROMAGNETIC SPECTRUM Progress Report, 1 Apr. 1979 - 31 Mar. 1980
George W. Flynn 31 Mar. 1980 186 p refs
(Contracts DAAG29-79-C-0079; DAAG29-80-C-0043; N00014-78-C-0517; ET-78-R-03-1876; DE-AS02-78ER-4940; Grants AF-AFOSR-0082-79; NSF ENG-76-16424; NSF MPS-75-0411; NSF CHE-77-11384; NSF CHE-77-24343)
(AD-A087034; PR-30) Avail: NTIS HC A09/MF A01 CSCL 07/4

Preliminary studies of spin relaxation of optically pumped sodium in xenon gas have shown that Van der Waals NaXe cause a substantial part of the relaxation. The electron-nuclear spin exchange cross section between Na and Xe129 has been

measured to be less than ten to the -19th power/sq cm. Calculations and preliminary experiments have shown that radiofrequency spectroscopic studies of the anomalously long lived 5D state of cesium are possible. Further studies of dense alkali vapors have shown that all of the alkali vapors sodium, potassium, rubidium and cesium, have absorption bands in the spectral region between 1 micron and 2.5 micron. The possibility that some of these bands might be useful for the construction of infrared excimer lasers is being investigated. GRA

N80-30618# Kansas Univ., Lawrence. Remote Sensing Lab.
RADAR BACKSCATTER STUDY OF SEA ICE
R. G. Onstott, George J. Dome, Clifford V. Delker, Javed S. Patel, and R. K. Moore Feb. 1980 273 p refs
(Contract N00014-76-C-1105)
(AD-A087032; CRINC/RSL-TR-331-14) Avail: NTIS HC A12/MF A01 CSCL 17/9

The ability to use radar to discriminate ice types has been investigated. Radar backscatter measurements were made of shorefast sea ice near Point Barrow, Alaska in May 1977 and April 1978, with a surface-based FM-CW scatterometer that swept from 1-2 GHz and from 8.5-17.5 GHz. The 1-2 GHz measurements showed that thick first-year and multiyear sea ice cannot be distinguished at 10 deg-70 deg incidence angles, but that undeformed sea ice can be discriminated from pressure-ridged thick first-year sea ice and lake ice. Results also indicate that frequencies between 8-18 GHz have the ability to discriminate between thick first-year sea ice, multiyear sea ice, and lake ice. The lowest frequency, 9 GHz, was found to provide the greatest separation between these ice categories with significant levels of separation existing between angles of incidence from 15 deg to 70 deg. The radar cross-sections for the like polarizations, VV and HH, were very similar in absolute level and angular response. The radar cross-sections for VV-polarization were usually the highest in absolute level. Cross-polarization provided a slightly greater separation between these categories of ice. GRA

N80-30619# Lockheed Missiles and Space Co., Palo Alto, Calif.
STUDY OF ELF PROPAGATION ANOMALIES AS RELATED TO IMPROVED KNOWLEDGE OF ELECTRON DENSITY PROFILES PRODUCED BY ENERGETIC PARTICLE PRECIPITATION Annual Technical Report
William L. Imhof, Robert C. Gunton, Tryve R. Larsen, Joseph B. Reagan, Edward E. Gaines, and Roland E. Meyerott 30 Jan. 1980 91 p refs
(Contract N00014-79-C-0175)
(AD-A087255; LMSC-D681778) Avail: NTIS HC A05/MF A01 CSCL 20/14

A study has been made of extremely low frequency (ELF) wave propagation anomalies as related to energetic particle precipitation, principally during solar particle events (SPE). Based on calculation of the predicted signal strengths at Tromso for transmissions from the Wisconsin Test Facility (WTF) a criterion has been selected for possible use in a field test operation. If the ion pair production rates at 40 km are equal to or greater than 1 x 1000/cc/sec then it is probable that a 3 dB or larger reduction in signal strength would occur for such an event. Since this preliminary criterion is based on ELF signal strength computation assuming no local time variations along the propagation path, more detailed calculations of the local time ionospheric effects should be performed. A study was made of the expected effect of local time variations during solar particle events on the ELF propagation over the path from WTF to Tromso. Electron and ion density profiles for the various segments of the test path were calculated with the ion chemistry model, taking into account the local time for each segment. In a comparison of conditions measured and calculated for SPE72 on 4 August 1972 near the peak of the event and conditions measured and calculated for a similar case assuming a season of 21 December, very little difference in signal strength attenuation over the path was found. GRA

N80-30620# Electronics Research Lab., Adelaide (Australia).
RADAR EMITTER RECOGNITION USING PULSE REPETITION INTERVAL
R. M. Hawkes Defence Research Centre, Salisbury, Australia Mar. 1980 59 p refs
(AD-A086968; ERL-0132-TR; AR-001-976; TR-3) Avail: NTIS HC A04/MF A01 CSCL 15/4

A method for estimating radar emitter pulse repetition interval parameters for intercepted emissions is presented. Adaptive parameter estimates based on certain measurements are derived. The measurements are obtained by a readily implementable observation procedure. The approach can deal with emitters with variable pulse repetition interval in a dense environment. Computer simulation results for the techniques are included. GRA

N80-30621# Sterling-Winthrop Research Inst., Rensselaer, N. Y.
ASSESSMENT OF THE CAPACITY OF THE AUTOMATED RADAR TERMINAL SYSTEMS (ARTS IIIA) FOR THE YEARS 1980-1990 Final Report, Oct. 1978 - Apr. 1980
W. Pailen, Hugh C. Wintermoyer, and Robert Sittler Jun. 1980 450 p refs Prepared in cooperation With Argon Crop., Waltham, Mass.
(Contract DOT-FA78WAI-942)
(AD-A087243; FAA-RD-80-51) Avail: NTIS HC A20/MF A01 CSCL 17/7

The capability of the ARTS 3A to support future air traffic growth and functional enhancements through 1990 is examined. The approach used is to investigate a few high traffic density sites which are representative of the three current terminal system configurations: single sensor sites (Detroit); dual sensor sites (Chicago, Los Angeles); and Metroplexes (New York). Loading factors are determined for each model site. These factors include the number and type of sensors and displays, the instantaneous traffic counts, and functional capability. The loading parameters are then used as inputs to a processing model, developed in this study, in order to determine if the ARTS 3A can provide adequate processing capacity. The loading parameters are also used to develop estimates of memory requirements. The results of the study indicate that processing capacity limitations, if not overcome, will likely constrain functional growth at Metroplex facilities but will present no problems for single and dual sensor sites. Current memory capacity limitations are shown to present significant problems for both Metroplexes and dual sensor sites. GRA

N80-30622# Naval Research Lab., Orlando, Fla.
STUDIES ON THE REDUCTION OF INTERMODULATION GENERATION IN COMMUNICATIONS SYSTEMS Final Report
G. H. Stauss, G. C. Bailey, C. D. Bond, C. A. Carosella, and A. C. Ehrlich 7 Jul. 1980 94 p refs
(AD-A086995; AD-E000492; NRL-MR-42) Avail: NTIS HC A05/MF A01 CSCL 17/2

Potential means of intermodulation generation in multiplex systems are reviewed and evaluated theoretically. The dominant mechanisms involve nonohmic junctions and ferromagnetic components. Junctions through aluminum oxide films have been studied experimentally and a possible means of improvement is described. Experimental tests of ferromagnetic components show the need to exclude them entirely from multiplex and high performance systems. With care in the choice and assembly of components, it is concluded that intermodulation signals can be kept to the level of thermal noise in most configurations. GRA

N80-30623# Technische Universitaet, Munich (West Germany). Lehrstuhl fuer Raumfahrttechnik.
A 35 GHz RADAR TO MEASURE PARTICLES IN RAYLEIGH FIELDS [EIN 35-GHZ-RADAR ZUR TEILCHENMESSUNG IM RAYLEIGH-BEREICH]
Klaus Kaufmann Aug. 1978 13 p In GERMAN
(TUM-RT-KB-78/4) Avail: NTIS HC A02/MF A01

The speed of free glass or metal particles with diameters of 0.1 to 1 mm in Rayleigh fields was measured using 35 GHz. The construction of the radar system, as well as the technical data, the measurements, the results and the future applications are outlined. Author (ESA)

N80-30624# Technische Universitaet, Munich (West Germany). Lehrstuhl fuer Raumfahrttechnik.
A 35 GHz DOPPLER RADAR TO MEASURE THE SPEED OF SMALL PARTICLES [EIN 35-GHZ-DOPPLERRADAR ZUR GESCHWINDIGKEITSMESSUNG KLEINER TEILCHEN]
Klaus Kaufmann May 1979 15 p In GERMAN

(TUM-RT-KB-79/2) Avail: NTIS HC A02/MF A01

A radar system is presented which detects particles smaller than 1 mm (up to 0.5 mm diameter). The analysis of the Doppler signal gives the speed of the free particle and its dimensions. The construction of the radar is outlined and the measurements on the acceleration presented. Author (ESA)

N80-30625# Technische Universitaet, Munich (West Germany). Lehrstuhl fuer Raumfahrttechnik.

DOPPLER RADAR MEASUREMENT IN HIGH SPEED FIELDS [DOPPLERRADARMESSUNGEN IM HOCHGESWINDIGKEITSBEREICH]

Klaus Kaufmann Jul. 1979 17 p In GERMAN

(TUM-RT-KB-79/8) Avail: NTIS HC A02/MF A01

Measurements of particles accelerated up to 5 km/sec from a light gas gun are given. Particle diameters were 1.5 mm, accelerated in a 250 Torr vacuum. Author (ESA)

N80-30626# Thomson-CSF, Paris (France). Dept. Espace-Satellites.

STUDY AND DEVELOPMENT OF A SLOTTED WAVEGUIDE ELEMENT IN AN ANTENNA ARRAY Final Report [ETUDE ET DEVELOPPEMENT D'UN ELEMENT D'ANTENNE RESEAU A GUIDES A FENTES]

Nov. 1979 183 p refs In FRENCH

(Contract ESA-3892/78-NL-AK(SC))

(ESA-CR(P)-1286) Avail: NTIS HC A09/MF A01

A configuration for an antenna waveguide array to be incorporated into a satellite synthetic aperture radar is presented. Different types of slot antennas are evaluated for their radio and electrical characteristics. A vertical slot waveguide is chosen and the testing of a simplified scale model of the antenna is reported. A mathematical performance prediction method is shown to be both comprehensive and valid. A final radar panel design is proposed, while its performance is caclulated for the 50 MHz frequency band. Author (ESA)

N80-30627# Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).

FUNDAMENTALS OF A THEORY FOR CONFORMAL ANTENNAS

C. vonWinterfeld Mar. 1979 22 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium der Verteidigung

(Rept-2-79) Avail: NTIS HC A02/MF A01

A fundamental matrix theory leading to the parameterization of conformal antenna radiation patterns of the horn radiator or thick dipole type is developed. It can be used as the basis for numerical investigations of conformal arrays or radar targets. The electromagnetic behavior of an antenna is represented by a scattering matrix. This matrix is derived from matrices, the elements of which are antilinear forms of mode functions corresponding to spherical waves of bounded regions or free space. The generalized nature of this approach is emphasized especially for implementation in a computer program.

Author (ESA)

N80-30628# Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).

A MAXIMUM LIKELIHOOD ESTIMATOR FOR THE EXTENT OF RADAR OR SONAR TARGETS USING HIGH RESOLUTION SIGNALS

F. Dommermuth Jul. 1979 32 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium der Verteidigung

(Rept-3/79) Avail: NTIS HC A03/MF A01

A maximum likelihood estimator for the length of a highly resolved radar or sonar target is introduced. Simplified assumptions concerning the statistics of echo and background noise make it possible to analyze its efficiency analytically. The time discrete output of the receiver is described as an exponential integral of a distributed random amplitude signal, the noise variable of which has the same distribution, thus reducing the variable echo plus noise. After optimization, the accuracy and sensibility of the exponentially distributed estimators was evaluated using computer simulation. Results show a signal to noise ratio of 10 dB with 50% confidence. Author (ESA)

N80-30629# Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).

WIDEBAND BEAMFORMER TO CONTROL A 38 ELEMENT SONAR ANTENNA

L. P. Wengert Sep. 1979 37 p refs In GERMAN; ENGLISH summary

(Rept-5/79) Avail: NTIS HC A03/MF A01

A brief description of the functional characteristics of charge transfer devices is given and various beamformer designs using these components are studied. A sonar beamformer (for a line array of 32 beams) operating in real time in the frequency range from 30 Hz to 2.3 KHz was built based on the 'series parallel structure' concept. A simulator for the generation of signals for twin independent wave fronts was used to measure beamformer performance. Results indicate that this beamformer design is comparable with alternative digital signal processing systems, while the beamformer presented remains ten times less expensive to build. Author (ESA)

N80-30630# Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).

MEASURING APPARENT TARGET LENGTH USING TARGET RESOLVING SIGNALS

J. Ziegenbein and F. Dommeruth Sep. 1979 30 p refs In GERMAN; ENGLISH summary

(Rept-6/79) Avail: NTIS HC A03/MF A01

Four algorithms for determining the duration of target resolving sampled echo signals are examined. Two algorithms are derived from maximum likelihood considerations, while the two other procedures are based on maximizing the detection index. Assuming target fluctuation statistics to be Gaussian and double Gaussian, the deviation between estimated apparent target length and true apparent target length was determined by computer simulations in terms of mean value deviation and variance. Results show that the maximum likelihood algorithms perform better if the signal to noise ratio is smaller than 10 dB, otherwise all of the algorithms are comparable. Author (ESA)

N80-30631# Centre National d'Etudes Spatiales, Toulouse (France).

INTRODUCTION TO THE STUDY OF NOISE IN CHARGED COUPLED DEVICES [INTRODUCTION A L'ETUDE DU BRUIT DANS LES DISPOSITIFS A COUPLAGE DE CHARGES]

Guy Rolland Jul. 1979 78 p refs In FRENCH; ENGLISH summary

(CNES-NT-90) Avail: NTIS HC A05/MF A01

Noise phenomena in charge coupled devices (CCD's) and in their associated circuitry are reviewed. The physics of CCD's operation, covering the mechanism of charge transfer, input circuit, output circuits, and photosensor principles, are explained. The description, localization, and analysis of different sources of noise are detailed. Emphasis is on photosensor signals, transfer register noise, and noise in distributed floating gate amplifiers as well as in floating diffusion amplifier. A noise measurement system designed to separate sources of noise in CCD's is then presented. Author (ESA)

N80-30632# Little (Arthur D.), Inc., Paris (France).

TREND ANALYSIS. SPACE COMMUNICATIONS SYSTEM TECHNOLOGY. PHASE 1: DEFINITION OF USER NEEDS Final Report

Malcolm H. Ross and Arthur Solomon 3 Dec. 1979 122 p refs

(Contract ESA-3789/78-F-FC(SC))

(ADL-82871F; ESA-CR(P)-1308) Avail: NTIS HC A06/MF A01

In order to specify and rank the technical goals for ESA space communication missions in the 1985-1995 period, the future development of telecommunication needs of countries was identified and the suitability of implementation by space systems was assessed. For countries other than in Western Europe the demand for telecommunication services for the 1985-1995 period was estimated for each country by consideration both of the status and plans of the existing networks and of the expected economic parameters for the period. A model was constructed to compare the costs of the different terrestrial and space communication systems that would meet the projected needs. For no country was a single service space communication system cost competitive with terrestrial systems. To have a chance of

being cost competitive with terrestrial systems some additional services need to be included in the space segment, or the space segment should serve more than one country in a region. Also, for Western Europe, it was concluded that a space implementation is not cost effective for communication services on a stand alone basis. Author (ESA)

N80-30633# Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
MULTI-USER TIME DIVISION MULTIPLE ACCESS (TDMA) AND SPREAD SPECTRUM (SS)-TDMA
G. B. Alaria, R. DeBassa, P. Destefanis, F. Pattini, and R. Pretti Feb. 1980 122 p refs
(Contract ESTEC-3857/78-NL-AK(SC))
(ESA-CR(P)-1324) Avail: NTIS HC A06/MF A01

An assessment was made of the feasibility and performance of equipment for a regenerative satellite which could accommodate users with nonuniform bit-rate requirements. Evaluation topics were dealt with in terms of band width, number of repeaters onboard, ground stations, and satellite fill factor as a function of the different user bit-rates. A semi empirical model was the basis for this analysis. An analysis was made of three possible solutions for the implementation of the bit-rate conversion process. A conceptual design of onboard hardware is presented, technologies to be used are identified, and circuit complexity and power requirements estimated. Author (ESA)

N80-30634# Politecnico di Torino (Italy). Ist. di Elettronica e Telecommunicazioni.
SIMULATION MODELS FOR MICROWAVE POWER TRANSISTORS UNDER LARGE SIGNAL OPERATING CONDITIONS. PART 1: THEORETICAL AND EXPERIMENTAL RESULTS Final Report
S. Benedetto, M. Biey, E. Biglieri, C. Naldi, U. Pisani, V. Pozzolo, G. P. Bava, F. Filicori (Bologna Univ.), and V. Monaco (Bologna Univ.) Dec. 1979 169 p refs
(ESA-CR(P)-1336-Pt-1) Avail: NTIS HC A08/MF A01

The problem of measuring, modeling, and analyzing class-C transistor amplifiers at high signal levels was studied. Transistor models were reviewed, and measurements of their parameters described. Computer simulation of microwave transistor amplifiers is then considered, and three solutions are proposed including: a harmonic-balance technique; a Volterra-series analysis technique; and a technique based on S-parameters. Results of the measurements performed on the amplifier are presented and compared with those obtained from simulation. Author (ESA)

N80-30635# British Aerospace Dynamics Group, Bristol (England). Communications and Countermeasures Group.
STUDY OF INTERFERENCES IN SATELLITE COMMUNICATION SYSTEMS. VOLUME 3: STUDY REPORT Final Study Report
K. Allsebrook, D. Pictor, and D. Salter Jul. 1979 134 p refs
Document includes a microfiche supplement 2 Vol.
(Contract ESTEC-3647/78-NL-AK(SC))
(ESS/CCG-66-Vol-3; ESA-CR(P)-1338-Vol-3) Avail: NTIS HC A07/MF A01

Literature on the subject of interference was summarized. Phase shift keying and analog FM systems, code division multiple access systems, recommended methods of computing the effect of an energy dispersed FM TV interferer on a narrow band victim receiver are included along with effects of interference on a phase-locked-loop receiver, and applicability of the models used, for the case of multiples interference. Author (ESA)

N80-30636# British Aerospace Dynamics Group, Bristol (England). Communications and Countermeasures Group.
STUDY OF INTERFERENCES IN SATELLITE COMMUNICATION SYSTEMS. VOLUME 4: EXECUTIVE SUMMARY
K. Allsebrook Jul. 1979 22 p refs 2 Vol.
(Contract ESTEC-3647/78-NL-AK(SC))
(ESS/CCG-67-Vol-4; ESA-CR(P)-1338-Vol-4) Avail: NTIS HC A02/MF A01

A computer library of calculation techniques was established, forming the basis of a reference set of procedures for determining the effects of an interfering signal on a wanted link. The programs were designed in an expandible, modular form. The literature was searched for appropriate methods of computing the baseband degradation for the particular wanted and interfering modulation types. The merits and difficulties in implementing each calculation method were assessed and the accuracy of the results produced were considered. Author (ESA)

N80-30637# National Technical Information Service, Springfield, Va.
PHASED ARRAYS. CITATIONS FROM THE NTIS DATA BASE Progress Report, Mar. 1976 - Mar. 1980
William E. Reed Apr. 1980 253 p
(PB80-808041; NTIS/PS-79/0411; NTIS/PS-78/0331) Avail: NTIS HC $30.00/MF $30.00 CSCL 09E

The design, performance, radiation patterns, and applications of phased arrays are presented in these Federally-sponsored research reports. Applications include communications, radar, optical, spacecraft, and navigational aids. This updated bibliography contains 244 abstracts, 44 of which are new entries to the previous edition. GRA

N80-30638# National Technical Information Service, Springfield, Va.
PHASED ARRAYS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1978 - Mar. 1980
William E. Reed Apr. 1980 163 p Supersedes NTIS/PS-79/0413; NTIS/PS-78/0332
(PB80-808058; NTIS/PS-79/0413; NTIS/PS-78/0332) Avail: NTIS HC $30.00/MF $30.00 CSCL 09E

The bibliography cites reports from worldwide research on the design, performance, radiation patterns, and applications of phased arrays. Applications include radar, communications, optical, electronic countermeasures, acoustic, aircraft, and spacecraft. This updated bibliography contains 157 abstracts, 73 of which are new entries to the previous edition. GRA

N80-30639# National Technical Information Service, Springfield, Va.
MICROWAVE COMMUNICATION. CITATIONS FROM THE NTIS DATA BASE Progress Report, Apr. 1976 - May 1980
William E. Reed Jun. 1980 287 p Supersedes NTIS/PS-79/0525; NTIS/PS-78/0525
(PB80-810631; NTIS/PS-79/0525; NTIS/PS-78/0525) Avail: NTIS HC $30.00/MF $30.00 CSCL 17B

Research reports pertinent to the techniques, equipment, reliability, and utilization of microwave communications are cited. Studies on microwaves relays, links, data transmission, telemetry, satellite communications, multiplexing, and propagation are included. This updated bibliography contains 280 abstracts, 46 of which are new entries to the previous edition. GRA

N80-30640# National Technical Information Service, Springfield, Va.
ELECTROMAGNETIC SHIELDING. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1972 - May 1980
William E. Reed Jun. 1980 309 p Supersedes NTIS/PS-79/0526; NTIS/PS-78/0524
(PB80-810649; NTIS/PS-79/0526; NTIS/PS-78/0524) Avail: NTIS HC $30.00/MF $30.00 CSCL 09C

The bibliography presents research on electromagnetic shielding of electronic and electrical equipment personnel, and ordnance. The shielding effectiveness of materials and structures is covered. Nuclear electromagnetic pulse shielding is included. This updated bibliography contains 301 abstracts, 19 of which are new entries to the previous edition. GRA

N80-30641# Federal Communications Commission, Washington, D. C. Policy Development Div.
UHF TASK FORCE: EXECUTIVE OVERVIEW AND SUMMARY Final Report
Raymond M. Wilmotte Jan. 1980 14 p refs
(PB80-177280; FCC/PRB/PDD/6) Avail: NTIS HC A02/MF A01 CSCL 17B

Estimates were made of the spectrum required for the operation of viable television stations up to the year 1990. Estimates of the spectrum needs of the civil maritime and aeronautical services were a fraction of those estimated by these industries because the task force took into account the expected and possible improvements in spectrum efficiency. In connection with land mobile, a development contract was granted leading

to an amplitude compandored single sideband system requiring a bandwidth of 5 KHz compared with 20-30 KHz of the current frequency modulation system. Consideration was given to using the forces of the marketplace instead of regulation for introducing spectrum saving technologies. GRA

N80-30321*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE TIDBINBILLA INTERFEROMETER
M. J. Batty (CSIRO, Sydney), D. L. Jauncey (CSIRO, Sydney), S. Gulkis, and M. J. Yerbury (Sydney Univ.) *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 6-8 ref (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 17B

N80-30333*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
USE OF K SUB A-BAND FOR RADIO METRIC DETERMINATIONS
P. D. Potter *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 59-66 refs (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 20N

N80-30335*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
CONCERNING THE FEASIBILITY OF A REAL TIME SAR DIGITAL PROCESSOR FOR VOIR LOW RESOLUTION IMAGING MODES
T. K. Truong and R. G. Lipes *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 72-81 refs (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 17I

N80-30336*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
FEASIBILITY AND COST STUDY ON VOIR SAR DATA TRANSFER VIA A BENT PIPE LINK
Y. H. Park and R. M. Goldman, Jr. *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 82-90 (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 17I

N80-30340*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
POWER LINE ANOMALIES AS THEY AFFECT THE OPERATION OF A DSN STATION: OVERVIEW
T. L. Potter *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 110-113 refs (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 20N

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N80-30642 California Inst. of Tech., Pasadena.
MONOLITHIC INTEGRATION OF GALLIUM ARSENIDE OPTOELECTRONIC DEVICES Ph.D. Thesis
Israel Ury 1980 103 p
Avail: Univ. Microfilms Order No. 8021028

The examples of the monolithic integration of optical and electronic devices on seminsulating GaAs substrates are described. In the first example, an injection laser was integrated with a Gunn oscillator to yield a high frequency modulated optical source. In the second example, an injection laser was integrated with a metal semiconductor field effect transistor (MESFET) which was used to modulate the current through the laser. In the third example, an integrated optical repeater was demonstrated which consisted of a MESFET optical detector, a current source, a transistor driver, and an injection laser all fabricated on a single chip. The repeater displayed an optical gain of 10 dB. A method was sought to form a laser cavity which did not occupy the entire width of a chip. The result was the demonstration of whispering gallery lasers which take the shape of quarter and half rings. The performance of the curved laser was reduced from that of the straight lasers due to optical scattering at imperfections along the curve. A general theory is developed which describes mode conversion in perturbed dielectric resonaters and is applied to the case of the whispering gallery laser and its predictions are compared with experiment. Dissert. Abstr.

N80-30643 Iowa State Univ. of Science and Technology, Ames.
SUPERCONDUCTIVITY IN Th-Nb COMPOSITES Ph.D. Thesis
Loren Frederick Goodrich 1980 143 p
Avail: Univ. Microfilms Order No. 8019631

Heat capacities, critical temperatures, and critical currents were measured for directionally solidified eutectic Th-Nb wires in order to determine whether superconductor normal metal boundary is a strong pinning center for quantized vortices. The heat capacity data show that there is a large change in pair potential at the super normal boundaries as predicted by de Gennes boundary length b, and to show that Ginsburg-Landua predicts the changes in the superconductors rather well. The equilibrium thermodynamical properites are predicted from the filament size and spacing rather well. Critical currents seem to be independent of the density of super normal boundaires and some other factors must control J sub c. The magnetic field dependence of C sub p and J sub c tend to confirm this conclusion. A field as small as 20 mT will decrease the pair potential in the normal metal by factors of 100 with no apparent change in J sub c. The critical current data was insensitive to Nb filament diameter over the range of 8 to 116 nm indicating that the superconductor normal metal interfaces were not effective pinning centers. Dissert. Abstr.

N80-30644 Cornell Univ., Ithaca, N. Y.
SUPERCONDUCTING DIAMAGNETISM IN SAMPLES OF SN(X), TaSe(3) AND NbS Ne(3) Ph.D. Thesis
Clifford Marc Bastuscheck 1980 157 p
Avail: Univ. Microfilms Order No. 8020793

The highly anisotropic metals (SN)x, TaSe3 and NbSe3 have shown low temperature behavior which could be associated with unusual superconducting properties. The present susceptibility measurements, made using a very sensitive SQUID magnetometer, were undertaken to add to the understanding of these new materials and to investigate the nature of superconductivity in the unusual systems which these materials present. The primary results of the investigation of samples TaSe3, and NbSe3 is the observation of superconducting diamagnetism and flux trapping indicating long range, stable superconducting phase coherence in the samples. However, the unusual dependence of the susceptibilities at very low tempertures (below 0.5 K) suggests that the samples contain a large fraction of normal meta. It seems possible that NbSe3 and TaSe3 are in fact not superconducting above 20 mK. Dissert. Abstr.

N80-30645*# SRI International Corp., Menlo Park, Calif.
ANALYSIS OF ELECTRICAL TRANSIENTS CREATED BY LIGHTNING Final Report
J. E. Nanevicz and E. F. Vance Hampton, Va. NASA. Langley Research Center Jul. 1980 107 p refs
(Contract NAS1-13792; SRI Proj. 4026)
(NASA-CR-159308) Avail: NTIS HC A06/MF A01 CSCL 09C

A series of flight tests was conducted using a specially-instrumented NASA Learjet to study the electrical transients created on an aircraft by nearby lightning. The instrumentation included provisions for the time-domain and frequency-domain recording of the electrical signals induced in sensors located both on the exterior and on the interior of the aircraft. The design and calibration of the sensors and associated measuring systems is described together with the results of the flight test measurements. The results indicate that the concept of providing instrumentation to follow the lightning signal from propagation field, to aircraft skin current, to current on interior wiring is basically sound. The results of the measurement indicate

that the high frequency signals associated with lightning stroke precursor activity are important in generating electromagnetic noise on the interior of the aircraft. Indeed, the signals produced by the precursors are often of higher amplitude and of longer duration that the pulse produced by the main return stroke.
Author

N80-30646# California Univ., Berkeley. Dept. of Physics.
SUPERCONDUCTIVE DEVICES FOR MILLIMETER WAVE DETECTION MIXING AND AMPLIFICATION
P. L. Richards and T-M Shen 1980 48 p refs
(Contract N00014-75-C-0496)
(AD-A086443) Avail: NTIS HC A03/MF A01 CSCL 20/3

Single particle (quasiparticle) tunneling through an insulating barrier between two superconductors or between a superconductor and a normal conductor is used to make very low noise detectors and mixers for millimeter wavelengths. The nonlinearity of the I vs. V curve obtained from tunneling between two superconductors can be so strong that classical theory breaks down and photon assisted tunneling theory must be used to understand device performance. Quantum theory predicts that a quasiparticle tunnel junction can be operated as a microwave photon detector with quantum efficiency close to unity or as a heterodyne mixer with conversion gain and with mixer noise temperature comparable with the quantum noise limit. Both of these predictions are experimentally realized using superconductor insulator superconductor junctions.
Author

N80-30647# Westinghouse Defense and Electronic Systems Center, Baltimore, Md. Systems Development Div.
HIGH VOLTAGE SWITCH USING EXTERNALLY IONIZED PLASMAS Final Technical Report, 26 Jun. 1978 - 21 Dec. 1979
John Dzimianski and Laurence E. Kline Wright-Patterson AFB, Ohio AFWAL Apr. 1980 80 p refs
(Contract F33615-78-C-2010; AF Proj. 2301)
(AD-A086761; DYD-55585-AA; AFWAL-TR-80-2041) Avail: NTIS HC A05/MF A01 CSCL 09/1

A physical model was developed and the performance parameters were studied for high voltage high current on/off switches which use the low energy secondary electrons in an electron beam (e-beam) sustained discharge as the conducting medium. The model equations are presented and described along with the underlying physical assumptions. Electron transport data and static breakdown voltages were calculated for N2, Ar, a N2:Ar = 1:9 mixture and CH4 by numerically solving the Boltzmann equation to find the energy distribution. Study of steady state performance for N2, Ar, N2:Ar = 1:9 and CH4 indicated that the N2:Ar = 1:9 and CH4 were both good candidate gases; hence transient switch performance was studied for these two gases. The performance of the e-beam plasma switches was mapped in a regime where the power delivered to the load is much greater than the e-beam power. Study of e-beam sources pointed to the thin film field emission cathode as offering a means of controlling e-beam plasma switches with very high control power gain. A switch geometry was suggested using such an e-beam source. The comparison of different switch types with on/off capability indicated that the e-beam externally ionized plasma switches have the potential to be developed into devices that would be competitive or superior in size and capability with any other approach providing equivalent electrical performance.
GRA

N80-30648# Auburn Univ., Ala. Dept. of Physics.
SECOND BREAKDOWN SUSCEPTIBILITY OF SILICON-ON-SAPPHIRE DIODES HAVING SYSTEMATICALLY DIFFERENT GEOMETRIES Final Report, 1 Jun. 1977 - 31 Dec. 1979
Paul P. Budenstein, Aradhana Baruah, Edward R. Knight, and Fu-Tai Kiou 30 May 1980 524 p refs
(Grants DAAG29-78-G-0111; DAAG29-77-G-0189)
(AD-A086345; ARO-15840.3-A-EL) Avail: NTIS HC A22/MF A01 CSCL 09/1

Experiments were performed on thin films silicon-on-sapphire (SOS) diodes (p(+) - n - n(+)) to determine the roles of geometry and doping level (ten to the 15th power to ten to the 17th power atoms/cubic centimeters) on current configurations, second breakdown susceptibility, and damage morphology. Geometric parameters varied including diode width, n-region length, n-region doping density, diffusion spikes of different sizes and configurations on the n(+)n or p(+)n interfaces, contact spikes at the n(+)-metal and p(+)-metal interfaces, and a variety of other current concentration geometries. Prior to the present study, the effectiveness of junction defects in reducing resistance to second breakdown was not known. However, it was suspected that such defects might result in 'maverick' devices, that is, devices which fail much below their rated electrical parameters. SOS diodes, specially fabricated by Rockwell International, were tested using Sunshine's stroboscopic technique. This method exploits the decrease of the optical transmittancy of silicon with increasing temperature.
GRA

N80-30649# TRW Defense and Space Systems Group, Redondo Beach, Calif. Electronics Technology and Devices Lab.
SURFACE ACOUSTIC WAVE MICROWAVE OSCILLATOR AND FREQUENCY SYNTHESIZER Interim Report, 1 Oct. 1979 - 1 Apr. 1980
D. J. Dodson and M. Y. Huang Jun. 1980 52 p
(Contract DAAB07-78-C-2992)
(AD-A086336; DELET-TR-78-2992-3; IR-3) Avail: NTIS HC A04/MF A01 CSCL 09/5

The objective of the program is the development of Surface Acoustic Wave (SAW) oscillator and synthesizer technology. The two year effort is planned as follows: Task 1 - Development of SAW devices for oscillator applications at microwave (L-band) frequencies. Emphasis to be placed on achieving wideband tuning capabilities, improved oscillator stability performance and reduced power requirements. Task 2 - Investigate UHF surface acoustic wave devices which can best impact on synthesizer performance parameters such as: switching speed, minimum frequency step size, total achievable bandwidth, short, medium and long term stability as well as maximum suppression of spurious mode level. Concurrently promising new synthesizer designs will be studied on the basis of these designs to arrive at target specification in a package providing a significant reduction in size, weight and power consumption. Since Task 1 was completed prior to this reporting period, during the third six months of the program design of the synthesizer circuitry was largely completed. SAW delay line/filters to be used in both the injection locked SAW oscillators and in the SAW Filter Bank have been designed and are being fabricated. The design of the delay lines was based partially on an investigation of the injection locking properties of SAW oscillators. RF/LSI circuitry has been processed and is currently being tested.
GRA

N80-30650# Southern Methodist Univ., Dallas, Tex. Dept. of Electrical Engineering.
ESTIMATION OF CONFIDENCE LIMITS FOR TESTING LARGE LOGIC NETWORKS Final Report
John L. Fike, C. H. Kapadia, B. Peikari, and K. Kavipurapu May 1980 85 p refs
(AD-A086281; AFOSR-80-0504TR) Avail: NTIS HC A05/MF A01 CSCL 09/3

This report describes a methodology and means for accurately determining confidence limits for the reliability of large digital networks, without exhaustively exercising all possible input sequences or simulating all logic faults in the network. The report is divided into two parts. In the first part, some mathematical models to estimate the reliability of digital circuits are presented. A heuristic method of assigning weights to faults depending on their 'importance' in a given circuit is described. The models presented can be used to: (1) predict the reliability of a circuit, (2) evaluate test sequences and (3) develop more accurate reliability models of (redundant) fault tolerant computers. The second part of the report deals with the statistical methods of estimating confidence limits.
GRA

N80-30651# Texas Instruments, Inc., Dallas.
RELIABILITY EVALUATION OF GaAs POWER FETs Interim Report, 7 Nov. 1978 - 6 Nov. 1979
H. M. Macksey and L. W. Joy Griffiss AFB, Ohio RADC Apr. 1980 91 p refs
(Contract F30602-79-C-0037; AF Proj. 2338)
(AD-A086668; TI-08-80-06) Avail: NTIS HC A05/MF A01 CSCL 09/1

The devices chosen for this study were the TI MSX802

and laboratory devices, Dexcel 3615A-P100F, MSC 88002, and NEC 868196. All are hermetically packaged GaAs power FETs with approximately 0.5 W output power. The study includes device physical, electrical (CW and pulsed), and environmental characterization, electrical (CW and pulsed) and environmental stress tests, and failure analysis. The device physical characterization has been completed and the data are presented. The CW electrical characterization is almost complete, and detailed data are shown for a typical device. No device had significant changes in electrical parameters following operation for 1000 hours at room temperature. The environmental characterization has just begun, and no results are available yet. The results from the cw electrical stress tests, which have been completed, are presented. There are some correlations between the various device structures and the results from different manufacture's devices. The environmental stress tests have begun, and preliminary results are presented. Most of the effort for the remainder of the program will be spent on completing these tests. The pulse characterization and stress tests have not yet begun. The failure analyses are described along with the test causing the failure. GRA

N80-30652# Strathclyde Univ., Glasgow (Scotland). Dept. of Applied Physics.
INTEGRATED THIN FILM dc SQUIDS Final Report, Nov. 1976 - 31 Oct. 1979
G. B. Donaldson Oct. 1979 27 p refs
(Grant DA-ERO-76-G-079; DA Proj. 1T1-61102-BH-57)
(AD-A086466) Avail: NTIS HC A03/MF A01 CSCL 20/3

A new thin film low temperature facility has been developed and used for work on three aspects of DC SQUIDS. First, ellipsometric studies have been made of the process of RF sputter etch oxidation of Pb-In alloys and of Nb. Second, structures based on Nb-NbOx-Pb/In Josephson junctions have been produced and successfully operated as planar SQUIDs with a flux noise of 0.000085 Phi sub o sq rt Hz. Finally, all Nb structures, based on Nb-NbOx/Au-Nb junctions, have been operated as SQUIDs though so far with inferior noise performance (0.05 Phi sub o sq rt Hz). Work is proceeding on the production of integrated magneometric structures using photolithographic techniques to etch planar flux transformers and the associated components. GRA

N80-30653# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
ARTWORK ANALYSIS TOOLS FOR VLSI CIRCUITS M.S. Thesis
Clark Marshall Baker Jun. 1980 78 p refs
(Contract N00014-75-C-0661)
(AD-A087040; MIT/LCS/TP-239) Avail: NTIS HC A05/MF A01 CSCL 09/5

Current methods of designing Very Large Scale Integrated (VLSI) chips do not insure that the chips will perform correctly when manufactured. Because the turnaround time on chip fabrication varies from a few weeks to a few months, a scheme other than try it and see if it works is needed. Checking of chips by hand simulation and visual inspection of checkplots will not catch all of the errors. In addition, the number of transistors per chip is likely to increase from ten thousand to over a million in the next few years. This increase in complexity precludes any manual verification methods; some better method is needed. A series of programs that use the actual mask descriptions for input are described. These programs perform various levels of checks on the masks, yielding files suitable for simulation. Some of the checks are the usual 'design rule' checks of looking for minimum line widths and adequate spacing between wires. However, there are many more constraints in VLSI circuits than are expressed by usual design rules. The programs check these constraints using the mask descriptions as input. All of the errors mentioned so far can be classified as syntactic errors; in addition, certain errors are detected. The detection of semantic errors requires various levels of simulation. The input to the simulators is derived from the artwork. GRA

N80-30654# Maine Master Electric Products Co., Winterport.
RESEARCH AND DEVELOPMENT OF CONCEPT LEADING TO AN AUTOMOTIVE ALTERNATOR WITH SIGNIFICANTLY IMPROVED EFFICIENCY AND WEIGHT Final Report, 1 Feb. 1979 - 31 Jan. 1980
Ray C. Noddin 5 Jan. 1980 26 p
(Contract DE-AC02-79CS-50042)
(COO-50042-1) Avail: NTIS HC A03/MF A01

A 20 to 25 percent improvement in both output/pound and efficiency relative to control performance of a present production Delco #1102848 alternator was achieved by substitution of a redesign stator of equal or smaller weight and size and in a configuration lending to low cost and manufacturability. Analysis of bench tests on the subject alternator incorporating the redesigned stator reveals an output/pound improvement of 30 percent thereby exceeding the design goal, and an average efficiency improvement of 25 percent easily equalling, and at most points of the performance curve, exceeding the design goal. This was achieved in a design employing proven, low-cost, high volume manufacturing techniques. The redesigned stator also lends itself to direct interchangeability with stators in production alternators. DOE

N80-30655# Oak Ridge National Lab., Tenn.
EDDY CURRENT HEATING OF IRREGULARLY SHAPED PLATES BY SLOW RAMPED FIELDS
Lawrence Dresner 1979 5 p refs Presented at 8th Symp. on Eng. Probl. of Fusion Res., San Francisco, 13 Nov. 1979
(Contract W-7405-eng-26)
(CONF-791102-167) Avail: NTIS HC A02/MF A01

Theorems are presented for estimating eddy current heating of irregularly shaped plates by a perpendicular ramped field. The theorems, derived from two complementary variational principles, give upper and lower bounds to the eddy current heating. Illustrative results are given for rectangles, isosceles triangles, sectors of circular annuli, rhombuses, and L shaped plates. A comparison is made with earlier work. DOE

N80-30656# Los Alamos Scientific Lab., N. Mex.
THE dc SUPERCONDUCTING POWER TRANSMISSION LINE PROJECT AT LASL: US DOE DIVISION OF ELECTRIC ENERGY SYSTEMS Final Progress Report, 1 Nov. 1972 - 30 Sep. 1979
F. J. Edeskuty, comp. Apr. 1980 270 p refs
(Contract W-7405-eng-36)
(LA-8323-PR; FPR-24) Avail: NTIS HC A12/MF A01

Plans for the development of a high capacity, underground dc superconducting power transmission line (dc SPTL) that uses Nb3Sn superconducting wires cooled to 12 K by gaseous helium are discussed. The dc SPTL offers a number of potential advantages including: no system stability or load flow constraints, lower short circuit current levels than any other transmission system; reactive compensation is not needed; no dielectric losses are exhibited; conductor losses are negligible; and the dc SPTL cable has the highest efficiency and current density capability of all cables. The requirement for such high power transmission capability is still several decades in the future and the SPTL technology is considered a high risk undertaking. Activities in electrical engineering, cryogenic engineering, and superconductor design are summarized. E.D.K.

N80-30657# Sandia Labs., Albuquerque, N. Mex.
COMPRESSED MAGNETIC FLUX AMPLIFIER WITH CAPACITIVE LOAD
O. M. Stuetzer Mar. 1980 27 p refs
(Contract EY-76-C-04-0789)
(SAND-79-2339) Avail: NTIS HC A03/MF A01

The operation of a compressed magnetic flux (CMF) transducer into an inductive-resistive load is discussed. A second order theory for this combination is considered with repect to the variation of skin depth with time, and flux trapping by wire shape and by two contact delay phenomena. An attempt to extend this second-order theory directly to the capacitive load case proved anaytically unfeasible. DOE

N80-30658# Sandia Labs., Albuquerque, N. Mex.
OPTICALLY COUPLED MICROWAVE SWITCH
Richard A. Kiehl and David M. Drury 1979 14 p refs Symp. held in Washington, D.C., 28 May 1980 Submitted for publication
(Contract EY-76-C-04-0789)
(SAND-80-0029C; CONF-800521-1) Avail: NTIS HC A02/MF A01

A new microwave switch that uses lightwaves to couple microwave energy between its ports is shown to offer outstanding performance in terms of on/off ratio and reverse isolation while exhibiting a state independent input impedance. DOE

N80-30658# Brookhaven National Lab., Upton, N. Y.
X-RAY EXAMINATION OF LAPPED ELECTRICAL INSULATION
A. C. Muller 1979 8 p Presented at the Conf. on Elec. Insulation and Dielectric Phenomena, Whitehaven, Pa., 21 Oct. 1979
(Contract EY-76-C-02-0016)
(BNL-27456; CONF-791028-4) Avail: NTIS HC A02/MF A01

The design and use of radiographic equipment for examining underground power transmission cable insulation for defects are described. The portable radiogrpahic equipment can be used to examine cables in factories, in test facilities, or at underground installations. Radiographs of plastic-wound and paper-wound cables are included. DOE

N80-30660# Danish Research Center for Applied Electronics, Hoersholm.
KEYBOARDS AND TOUCH CONTROLS: AN EVALUATION OF RELIABILITY AND CONSTRUCTIONAL PRINCIPLES FOR 11 DIFFERENT TYPES
E. Johansen, S. T. Olesen, and A. Willumsen Oct. 1979 45 p refs Sponsored by Sammenslutningen for Paalidelighedsog Miljoeteknik (SPM) and Danish Council of Technology
(ECR-90) Avail: NTIS HC A03/MF A01

A 'performance quality' evaluation of 11 different varieties of keyboards and touch controls was made. The devices tested include seven keyboards of the push button type, two plane design keyboards, a Hall-element switch, and a capacitive touch control. The same test procedures were used on all the devices, regardless of their quality or price class, as only real performance is of interest. The tests covered mechanical endurance, thermal exposure, humidity exposure, H2S and SO2 exposure, a solder examination, a vibration test, and the measurement of contact bounce. In the case of destructive testing, contact resistance serves as the control factor. All test results are related to an analysis of construction design. Author (ESA)

N80-30661# Instituto de Electronica de Communicaciones, Madrid (Spain). Dept. de Microondas.
STUDY AND DEVELOPMENT OF PRINTED CIRCUIT ELEMENTS FOR SYNTHETIC APERTURE RADAR ARRAY ANTENNAS Final Report
J. Barbero Sanchez, F. Jimenez Asenjo, R. Villar Gomez, M. Peralta Bellido, J. Torres Riera, and F. Vila Castelar Oct. 1979 234 p refs Prepared in cooperation with Instituto Nacional de Tecnica Aeroespacial, Esteban Terradas, Torrejan de Ardoz (Spain)
(Contract ESTEC-2683/78-NL-AK(SC))
(ESA-CR(P)-1303) Avail: NTIS HC A11/MF A01

A general presentation of the state-of-the-art on planar array antennas is combined with a technical discussion and selection of the best suited elements for circular patch and slot-stripline radiators. The mutual coupling between radiators in several types of 1 X 8 arrays with circular patch elements was examined to optimize the distances between them in the complete SAR array antenna. A simple microstrip feeding network with low permittivity substrate, easy to realize by photoetching was designed and measured. The impedance and radiation pattern of a 2 x 8 subarray fed by the preceding network was measured. The performance of elementary radiators concerning resonant frequency, impedance, bandwidth, radiation pattern, polarization, and efficiency were studied. The advantages and disadvantages and the influence of mechanical tolerances on their electromagnetic behavior was investigated. Author (ESA)

N80-30662# Sira Inst. Ltd., Chislehurst (England).
EVALUATION OF RADIATION EFFECTS IN THE MA328 CCD IMAGE SENSOR Final Report
D. J. Purll, B. T. Meggitt, R. A. A. Freeman (Fulmer Research Inst. Ltd.), and A. G. Holmes-Siedle (Fulmer Research Inst. Ltd.) Jan. 1980 146 p refs
(Contract ESTEC-3748/78)
(Sira-6/5309/00; ESA-CR(P)-1317) Avail: NTIS HC A07/MF A01

Information specifically useful to the ESA Polaris Sensor development was obtained by irradiating several CCD's with gamma radiation to a maximum dose of 20 krad, compared with the estimated 5 year geostationary dose of 5 krad. The clearest results were those concerning trapped charge and interface state build-up in the charge transfer areas of the devices. Operation of the shift registers in the space radiation environment would appear to present no problem. Changes in both response and dark current nonuniformities show the necessity for dynamic rather than prelaunch calibration in high accuracy applications. The output circuitry, comprising a number of MOS transistors, was more sensitive, and the complex nature of interdependences between bias voltages in this region is indicated. Optimum operation was restored in one device after a dose of 20 krad by a small adjustment of substrate voltage alone. Other problem areas are the incidence of catastrophic failures even in the absence of radiation damage, and of major defects which appeared in initially good devices after relatively small doses of radiation. Author (ESA)

N80-30663# British Aerospace Dynamics Group, Bristol (England).
STUDY AND EVALUATION OF MODULAR PACKAGING TECHNIQUES FOR ON BOARD DATA HANDLING: TECHNOLOGY ASSESSMENT Final Report
J. Perry, comp. Nov. 1979 64 p refs
(Contract ESTEC-2840/76-NL-HP(SC))
(ESS/SS-918; ESA-CR(P)-1327) Avail: NTIS HC A04/MF A01

The detailed design and the manufacture of a test model for environmental testing of a Modular Packaging Scheme for use with the On Board Data Handling System was completed. During the development/testing phase, redesign and modifications were implemented to meet the severe vibration levels imposed. This phase was completed by successful vibration testing to the worst case envelope covering Ariane, Shuttle and Thor-Delta. The unit design was mass optimized and the manufacturing tolerances were finalized. A representative OBDH configuration unit was again manufactured and vibration tested. Author (ESA)

N80-30664# United Kingdom Atomic Energy Authority, Harwell (England). Materials Development Div.
FURTHER FABRICATION STUDIES OF DRY LUBRICATED SLIP RING BRUSH MATERIALS FOR SATELLITE APPLICATIONS
K. T. Scott and K. R. J. Cottell Nov. 1979 47 p refs
(Contract ESTEC-3284/77-NL-PP)
(AERE-G-1480; ESA-CR(P)-1331) Avail: NTIS HC A03/MF A01

A vacuum hot pressing technique was developed for the fabrication of slip ring brush material consisting of 10, 7.5 and 5W/o MOS2 dispersions in an Ag-3.0W/o CU matrix. The densities (96-97%) theoretically obtained with the new mixtures were slightly lower than those reached in previous work. Microstructural investigation revealed the MOS2 to be predominantly distributed at the grain boundaries by with incomplete coverage at the lowest sulphide loading. There was a definite pressing texture but also some evidence that the pressing parameters might be near a limit beyond which rapid grain growth in the metal matrix would take place. A processing procedure for the production of slip ring brush material was written. Author (ESA)

N80-30665# National Bureau of Standards, Boulder, Colo. National Engineering Lab.
DEVELOPMENT OF STANDARDS FOR SUPERCONDUCTORS Annual Report, 1979
F. R. Fickett Dec. 1979 46 p refs
(Contracts DE-PR01-79ET-52052; DE-PR02-79ET-26803; DE-PR01-79ER-10354)
(PB80-175417; NBSIR-80-1629) Avail: NTIS HC A03/MF A01 CSCL 20L

A set of useful voluntary standards for measurements on modern practical superconductors that will be acceptable to both manufacturers and users is investigated. Agreement on a set of standard definitions for the various parameters is also necessary.

The status of the program is described and a brief historical introduction is included. The need for standards in this area is described in detail with particular attention paid to the need for consensus among all interested parties and the techniques for achieving it. Results from experimental research and a review of the wire manufacturers programs are presented. GRA

N80-30666# National Technical Information Service, Springfield, Va.
INTEGRATED CIRCUIT RELIABILITY. CITATIONS FROM THE NTIS DATA BASE Progress Report, Apr. 1978 - May 1980
William E. Reed Jun. 1980 201 p Supersedes NTIS/PS-79/0602; NTIS/PS-78/0579
(PB80-811128; NTIS/PS-79/0602; NTIS/PS-78/0579) Avail: NTIS HC $30.00/MF $30.00 CSCL 09E

The bibliography presents research pertinent to design, reliability prediction, failure and malfunction, processing techniques, and radiation damage. This updated bibliography contains 193 abstracts, 17 of which are new entries to the previous edition. GRA

N80-30667# National Technical Information Service, Springfield, Va.
LIGHTNING, SURGE AND TRANSIENT PROTECTION. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1978 - Apr. 1980
William E. Reed Jun. 1980 114 p Supersedes NTIS/PS-79/0154; NTIS/PS-78/0187
(PB80-810781; NTIS/PS-79/0154; NTIS/PS-78/0187) Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 09C

Techniques and devices for the protection of electronic and electrical equipment are presented in these Federally sponsored research reports. The citations include research on suppressors, limiters, lightning arresters, electromagnetic pulse protection devices, and overvoltage protection networks. Electromagnetic shielding is excluded. This updated bibliography contains 106 abstracts, 44 of which are new entries to the previous edition. GRA

N80-30334*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
QUICKLIST: THE BASIS FOR A COMPUTER AIDED LOGIC DESIGN SYSTEM
W. A. Lushbaugh *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 67-71 (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 09C

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N80-30668 Virginia Polytechnic Inst. and State Univ., Blacksburg.
STABILITY OF BOUNDARY-LAYER FLOWS OVER CURVED WALLS Ph.D. Thesis
Jerzy Maciej Floryan 1980 175 p
Avail: Univ. Microfilms Order No. 8020206

The formal analysis of the Gortler-type instability is presented. The boundary layer equations and the disturbance equations are formulated in a general, orthogonal, curvilinear system of coordinates constructed from the inviscid flow over a curved surface. Effects of the curvature of the wall on the boundary layer flow are analyzed and are shown to be insignificant for the intended stability analysis. The basic approximation for the disturbance equations is presented and solved numerically. Previous analyses are discussed and compared with the present one. Results show the importance of the boundary layer growth and are in a good agreement with the experimental data. Effects of suction are introduced and are shown to stabilize the boundary layer. Dissert. Abstr.

N80-30669 Oregon Univ., Eugene.
THE SHEAR VISCOSITY FOR THE SOFT SPHERE LIQUID VIA DISCRETE CELL HYDRODYNAMICS Ph.D. Thesis
Salma Begum 1980 154 p
Avail: Univ. Microfilms Order No. 8018847

The shear viscosity and the longitudinal momentum transfer for the soft sphere liquid was calculated numerically by computer simulation using a discrete cell hydrodynamics method. It is based on a formulation which is discrete in space and time. For the soft sphere viscosity, there is good agreement between the nonequilbrium molecular dynamics calculation and the discrete cell hydrodynamics results. The discrete cell hydrodynamics method is also over 50 times more efficient than previous methods because the discrete method is not sensitive to large scale fluctuations as other methods. Thus, the discrete cell hydrodynamics method is more useful for calculating fluid transport properties. Dissert. Abstr.

N80-30670 Idaho Univ., Moscow.
SIMILITUDE MODELING OF NATURAL CONVECTION HEAT TRANSFER THROUGH AN APERTURE IN PASSIVE SOLAR HEATED BUILDINGS Ph.D. Thesis
Dennis David Weber 1980 123 p
Avail: Univ. Microfilms Order No. 8019798

An experimental study of natural convection heat transfer through a doorway in a two room passive solar heated building is described. Similitude modeling was the method used to measure natural convection heat transfer coefficients in a model geometrically scaled down by a factor of five. Freon gas was used as the working fluid to obtain dynamic similarity within the model. A temperature difference was maintained between the two rooms by a heated vertical wall which simulated a thermal storage wall in the other room. Heat transfer through the doorway was measured as a function of a characteristics temperature differential and the geometry of the doorway. A comparison of the results of this work with previous full scale studies and with the theory shows good correlation. Deviation of the Grashof number dependence from the theoretical predictions were caused by errors in assumptions of the relationship between the characteristic temperature differential and the temperature differences in the doorway. Velocity and temperature profiles measured in the doorway allowed a critical examination of these assumptions. Dissert. Abstr.

N80-30671 Minnesota Univ., Minneapolis.
FLUX-SPLINE METHOD FOR HEAT, MASS AND MOMENTUM TRANSFER Ph.D. Thesis
Luciano Magno Costalonga Varejao 1980 257 p
Avail: Univ. Microfilms Order No. 8019584

A more accurate numerical method was developed for heat, mass, and momentum transfer. In the method, called Flux-Spline Method, the discretization equation for the dependent variable is obtained by assuming that its associated total (convection + diffusion) flux is linear within the control volume. The method was applied to several test problems where it is shown that its accuracy and order of accuracy are much higher than those of the conventional exponential methods. Dissert. Abstr.

N80-30672 Auburn Univ., Ala.
A THEORETICAL STUDY OF DEVELOPING GAS-LIQUID FLOWS IN VERTICAL PIPES Ph.D. Thesis
Hany Mahmound Fahmy Aly 1980 139 p
Avail: Univ. Microfilms Order No. 8019883

The current theory of two phase flow was evaluated with emphasis on the mathematical modeling of two phase flow. The mathematical formulation of the two phase flow is generally associated with many constitutive relations as well as uncertainty in specifying the interaction terms between phases. The flow of two dispersed phases can best be described by the mixture theory. Some possible mixture models are described and discussed. The problem of developing, axisymmetric, laminar flow of gas liquid mixtures in circular pipes was formulated in terms of the single phase (or homogeneous flow) model and the diffusion model. The resulting set of non linear partial differential equations was solved numerically by using the step-by-step marching integration technique. The effect of the relevant parameters were investigated. The flow field was found to be affected by both

the void fraction and the void-fraction profile which is affected by the diffusion as the flow continues to develop. Dissert. Abstr.

N80-30673 California Inst. of Tech., Pasadena.
THE TRANSLATIONAL MOTION OF PARTICLES IN A VISCOELASTIC LIQUID Ph.D. Thesis
Grant Fred Tiefenbruck 1980 260 p
Avail: Univ. Microfilms Order No. 8020434

The translation motion at low Reynolds number of a slender rod near a vertical wall was studied. When the rod is not too near the wall, its motion is found to be in qualitative agreement with theoretical solutions for the motion of a rod in an unbounded second-order fluid. When the rod is nearer to the wall its motion is shown to correspond qualitatively to a simple superposition of the motion in an unbounded second-order fluid and the motion in a Newtonian fluid near a vertical wall the equations governing the motion of a solid sphere and a spherical bubble in a viscoelastic fluid of infinite extent were solved numerically. The computed solutions were compared with analytic solutions obtained by asymptotic theory considerably beyond the expected range of validity. Many features of the flow can be described by the model fluid behavior in shear and extensional flows. Dissert. Abstr.

N80-30674 Lehigh Univ., Bethlehem, Pa.
THE ANNULAR HEAT PIPE OPERATING LIMIT EQUATIONS AND CHEMICAL REACTOR APPLICATION Ph.D. Thesis
Yves Parent 1980 205 p
Avail: Univ. Microfilms Order No. 8019722

Capillary limit predictions based on the bi-dimensional liquid pressure distribution were compared using a simplified unidimensional model which is suggested by a conventional axial heat pipe design procedure. The possibilities of integration of the AHP device to a chemical reactor system were investigated using a simplified one dimensional tube will reactor model with the catalytic partial oxidation of Naphthalene kinetics. The behavior of this system with and without the AHP was compared for a range of operating reactor temperature and also feed temperature. Although operational parameters chosen were optimal in relation to the system without AHP, the system incorporating the AHP device suggests interesting advantages. The analysis also shows some inconsistencies in the reactor behavior beyond a given operating reactor temperature. It is believed that such a situation stems from a multiplicity of solutions inherent to the model chosen. The relative important of final heat sink coupling is demonstrated and various design options, suitable for application to the system at hand, are presented and discussed.
Dissert. Abstr.

N80-30675 Polytechnic Inst. of New York.
LAMINAR NATURAL CONVECTION ALONG VERTICAL CORNERS AND RECTANGULAR DUCTS Ph.D. Thesis
K. Ramakrishna 1980 243 p
Avail: Univ. Microfilms Order No. 8019411

The flow along a vertical right angle corner formed by the intersection of two vertical semi-infinite flat plates whose surface temperature varies according to the relation T(w) - T(infinity) = Nx sub n was analyzed by an asymptotic expansion procedure. The interaction of the boundary layers developing on the two plates or the corner results in a three dimensional flow in the corner region. A similarity solution is found to exist for the nonuniform surface temperature at the corner plates defined by T(w) - T(infinity) = Nx sub n. The resulting flow equations are numerically solved by a strongly implicit finite difference procedure using Stone's algorithm. The governing equations of flow in rectangular ducts were nondimensionalized by different dimensionless parameters for isothermal and constant heat dissipation conditions at the duct walls. The simultaneous development of velocity and temperature in the entrance length of isothermal and constant heat flux square ducts are calculated using a marching procedure and a strongly implicit finite difference procedure using Stone's algorithm in the cross plane.
Dissert. Abstr.

N80-30676 Princeton Univ., N. J.
A COMPARISON AMONG VARIOUS THEORIES FOR TURBULENT, REACTING, PLANAR MIXING LAYERS Ph.D. Thesis
Stephen Flanders Parker 1980 216 p
Avail: Univ. Microfilms Order No. 8019825

The planar, turbulent, mixing layer was analyzed for both nonreacting, variable density flows and reacting flows. A coordinate transform was employed to remove the singularity at the mixing layer edge, which appears when the laminar diffusivity is neglected where the turbulent diffusivity goes to zero. An iterative quasilinearized implicit finite difference scheme was used to solve the governing set of equations. For the nonreacting flows similarity solutions were obtained. Comparisons were made among the computational results and with existing experimental data. The major differences between the models and types of averaging were in the predicted spreading parameter. For reacting flow, two different approaches to the calculation of the ignition length were analyzed. In both approaches several different kinetic models were employed. Comparisons among the models indicated significant sensitivity to the form of averaging and the choice of kinetic remodeling with a lesser sensitivity to the choice of turbulence modeling. Dissert. Abstr.

N80-30677 Polytechnic Inst. of New York.
BUBBLE DYNAMICS IN STRUCTURAL FOAM PROCESSING Ph.D. Thesis
Hee Ju Yoo 1980 211 p
Avail: Univ. Microfilms Order No. 8019419

The stress distribution of viscoelastic polymer melts in a converging channel were determined by measuring wall normal stress and stress birefringence. The Coleman-Noll second order fluid was used to derive theoretical expressions for the wall normal stress, and shear, and shear and normal stresses in the converging flow field. Bubble dynamics in foam extrusion through a converging die was studied by recording bubble dynamics in the flow channel on movie films as a gas charged molten polymer was extruded. A theoretical analysis was made of bubble dynamics in which a threadlike bubble was assumed to flow along the center line of the die and the Coleman-Noll second fluid model was assumed to described the rheological behavior of the gas charged molten polymer. Bubble growth during mold filling was recorded on a movie film as gas charged molten polymer was injected into a mold cavity. A theoretical study of bubble growth in foam injection molding was conducted in which a spherical bubble was assumed to grow after the injection nozzle was closed and the DeWitt models assumed to describe the rheological behavior of gas charged molten polymers. The cell size and distribution of molded specimens as affected by processing variables was investigated by employing short-shot molding process under isothermal conditions. Dissert. Abstr.

N80-30678 Carnegie-Mellon Univ., Pittsburgh, Pa.
NONSYMMETRIC SPLIT OF FLOW DURING COCURRENT UPFLOW AT AIR-WATER MIXTURES THROUGH SYMMETRIC BIFURCATIONS Ph.D. Thesis
Mark Daniel Freier 1980 179 p
Avail: Univ. Microfilms Order No. 8020154

In order to approximate the flow channels in a packed bed, the bifurcations were either U-tubes of small diameter, 4 - 8 mm, or a knife edge, which splits a 1/4 inch I.D. tube into two semicircular channels. The length of the parallel tubes or channels was varied between 10.0 and 100.0 cm. At low air and water flowrates the flow splits nonsymmetrically. Nonsymmetric flow occurs because the symmetric becomes unstable to perturbations in air split, at low air flow. The negative slope of the pressure drop versus air flowrate curves in this region indicates that an increase in air flow in one tube will lead to a pressure decrease, which will cause more flow to enter that tube. Opposing this transition is the pressure drop required to accelerate the flows in the one tube. The transition from symmetric flow is predicted based on the balance of these two pressure drops. The agreement between actual and predicted air flowrates at which the transition will occur is reasonable. A model was developed to estimate the response of the water in the slow flowing tube. It was found that most transitions occurred at calculated amplitudes of response of between 2.5 and 4.0 cm. Dissert. Abstr.

N80-30679 Virginia Polytechnic Inst. and State Univ., Blacksburg.
INTERACTING INVISCID AND LAMINAR VISCOUS FLOW, AND SOME ASPECTS OF THEIR STABILITY Ph.D. Thesis
Saad Aly M. Ragab 1979 207 p

Avail: Univ. Microfilms Order No. 8020226

The method of matched asymptotic expansions is used to obtain a second order triple deck solution for the case of constant wall temperature. It includes the problem of an adiabatic wall as a special case. A second order accurate finite difference scheme is developed for solving the lower deck equations. The theory is applied to supersonic flows past compression ramps and incompressible flows over small humps with small bubble separation. Also a numerical method for integrating the interacting boundary layer equations for incompressible flows is developed. For incompressible flows over small humps the first order theory is in good agreement with the interacting boundary layer. By including the second order terms in the triple deck theory, better agreement is obtained. For supersonic flows past corners, the agreement between the triple deck theory and solutions of the full Navier-Stokes equations is improved only in the free interaction region for an adiabatic wall. The second order theory breaks down for cold walls. Dissert. Abstr.

N80-30680 California Inst. of Tech., Pasadena.
NON-NEWTONIAN MIGRATION OF A DEFORMABLE DROP IN SHEARING FLOWS Ph.D. Thesis
Paul Chun-Ho Chan 1979 126 p
Avail: Univ. Microfilms Order No. 8019897

The lateral migration of a deformable drop suspended in a unidirectional shearing flow of a slightly nonnewtonian fluid was considered both theoretically and experimentally. Analytical expressions for the migration velocity due to the separate effects of drop deformation and fluid viscoelasticity were obtained for a two dimensional flow and then extended to the case of a general quadratic flow. The direction and magnitude of the migration velocity was calculated for the particular cases of Poiseuille flow in a tube and linear shear flow, and compared with experimental data. The Couette flow problem was studied experimentally. The size of the inner rotor of the Couette device was varied systematically to assess the role of velocity profile curvature on drop migration. Both deformation and nonnewtonian effects were considered. Significant observations not reported in previous studies include the migration of a deformable Newtonian drop to an equilibrium position between the centerline and the inner rotor and the close competition between normal stress and shape deformation contributions for the case of a Newtonian drop in a nonnewtonian fluid. Dissert. Abstr.

N80-30681 North Carolina State Univ., Raleigh.
SYMMETRY MAPPINGS AND CONSERVATION LAWS IN RELATIVISTIC FLUIDS Ph.D. Thesis
Davis Regoalt Oliver 1979 165 p
Avail: Univ. Microfilms Order No. 8020503

Certain matter symmetries, which may not coincide with geometric symmetries are described in relation to investigations of conservation laws admitted by certain relativistic fluids. In particular, the role matter symmetries in investigations of this kind is elaborated and further developed in relation to the following: (1) hydrodynamic descriptions of relativistic fluid; (2) the Cauchy problem for general relativistic fluid; (3) thermodynamic and kinetic theory models for relativistic fluid and;(4) certain relativistic charged fluids. Only symmetries which can be described by point mappings on the space-time manifold or tangent bundle are considered. Symmetries of this type can be naturally defined in terms of Lie deformations of various physical and geometric objects. Dissert. Abstr.

N80-30682 Toledo Univ., Ohio.
MARANGONI BUBBLE MOTION IN ZERO GRAVITY Ph.D. Thesis
Robert Lloyd Thompson 1979 417 p
Avail: Univ. Microfilms Order No. 8019363

The Marangoni phenomenon is propsed as the primary mechanism for the movement of gas bubble in a nonisothermal liquid in a low gravity environment. In such a two-phase flow system, local variations in surface tension at the bubbles surface can be caused by a temperature gradient in the liquid. Shearing stresses thus generated at the bubble surface lead to convection in both media, as a result of which the bubble begins to move. A mathematical model consisting of the Navier-Strokes and thermal energy equation, together with the appropriate boundary conditions for both media is presented. Parameter perturbation theory is used to solve this boundary value problem, with the expansion parameter being the Marangoni number. The zeroth, first and second order approximation for the velocity, temperature and pressure distribution in the liquid and in the bubble, and the deformation and terminal velocity of the bubble are determined. Comparison of the zeroth-order analytical results for the bubble terminal velocity showed good agreement with the experimental measurements. Dissert. Abstr.

N80-30683 Minnesota Univ., Minneapolis.
TURBULENT HEAT TRANSFER AND FLUID FLOW CHARACTERISTICS FOR AIR FLOW IN AN UNSYMMETRICALLY HEATED TRIANGULAR DUCT Ph.D. Thesis
Carlos Alberto Carrasco Altemani 1980 191 p
Avail: Univ. Microfilms Order No. 8014507

Experiments were performed to obtain the heat transfer and friction factor characteristics for an asymmetrically heated triangular duct. Two of the walls were heated so as to obtain axially uniform heat flux and circumferentially uniform temperature. The third wall was made of an insulator plastic material and was not directly heated. Another triangular duct, with identical inner geometry, was positioned upstream of the heated duct and served as the hydrodynamic development duct. The experimentally determined thermally developed values of the Nusselt number were compared to correlations found in the literature for turbulent heat transfer in uniformly heated circular tubes. The predicted values were at least 15 per cent higher than the measured ones. A modification of the Petukhov-Popov equation, using the actual measured values of the friction factor for the heating runs, predicts values of the Nusselt number within 5 per cent of the measured values. The measured values of the Stanton numbers were within 4 per cent of those from a numerical finite-difference solution from the literature. Dissert. Abstr.

N80-30684 California Inst. of Tech., Pasadena.
NATURAL CONVECTION FILM BOILING ON A VERTICAL SURFACE Ph.D. Thesis
David C. Sherman 1980 213 p
Avail: Univ. Microfilms Order No. 8020429

Experimental results are presented for an investigation of free convection film boiling heat transfer to saturated ethanol, saturated Freon 113, and saturated distilled water from a vertical cylinder. High speed motion pictures of the vapor-liquid interface in film boiling were obtained. All tests were conducted at atmospheric pressure over a range of heat flux between 9000 and 37000 BTU hr sq ft. A study of the stability of the vapor-liquid interfaces is performed and the results are compared to the photographic data. Parameters influencing the heat transfer process are developed and the experimental data is used to determine their proper relationship. The heat transfer coefficient in natural convection film boiling of saturated liquids on moderately long vertical surfaces at constant heat flux is shown to be insensitive to vertical position, and to be dependent only on the temperature differential and the fluid properties. A strong possibility of liquid droplet entrainment in the vapor flow is indicated by the presence of a rough, wavy interface, and relatively high speed vapor-flow, and by the unexpectedly strong dependence of the heat transfer on the latent heat of vaporization. Dissert. Abstr.

N80-30685 Delaware Univ., Newark.
THE EFFECT OF SUSPENDED SOLIDS ON THE VISCOUS DRAG ON AN OSCILLATING DISK Ph.D. Thesis
Chun-Hsun Rin 1980 134 p
Avail: Univ. Microfilms Order No. 8019920

The problem of a rigid, neutrally buoyant sphere above an infinitely long flat plate oscillating in its own plane in an incompressible viscous fluid was studied. An approximate solution of the unsteady Stokes equation is obtained for the fluid velocity, the translational and the rotational velocities of the sphere by the method of reflections up to the first reflection. The formulae for the drag and the torque on the sphere, the shear stress on the plate, the energy dissipation of the plate motion were derived. The solution is valid in a region within the boundary layer but not too close to the wall, i.e., for small ratio of sphere radius to distance of its center from the wall. The results were compared with the classical solution of an infinite flat plate oscillating in a viscous fluid and were discussed in terms of the physical

parameters of the problem. Applying the single particle results to an assembly of particles in a dilute suspension, the formula for suspension viscosity was derived. The result is in close agreement with Einstein's formula for suspension viscosity. The theoretical result indicates that the viscous drag on the oscillating disk increases when solid particles are present in the fluid. Dissert. Abstr.

N80-30686*# Lockheed Missiles and Space Co., Huntsville, Ala.

NUMERICAL ANALYSIS OF NATURAL CONVECTION IN TWO-DIMENSIONAL SQUARE AND CIRCULAR CONTAINERS IN LOW GRAVITY Interim Report

S. J. Robertson, L. W. Spradley, and M. P. Goldstein Aug. 1980 39 p refs

(Contract NASw-3281)

(NASA-CR-163487; LMSC-HREC-TR-D697821) Avail: NTIS HC A03/MF A01 CSCL 20D

A numerical study of natural convection in circular cylinder and square enclosures shows that the analytic low Rayleigh number theory of previous investigators is valid for Rayleigh numbers up to 1000. For a Rayleigh number of 5000, steady state values of maximum fluid velocity differ by 20 percent. This deviation between analytic theory and numerical results increases for higher Rayleigh numbers. In addition, the low Rayleigh number theory is shown to be valid for higher Rayleigh numbers for a portion of the transient phase before significant deviation becomes apparent. It is also shown that square shaped experimental configurations may be analytically approximated with good accuracy by circular cylinders of equal cross sectional area for the prediction of convection velocities and flow patterns at low Rayleigh number. Author

N80-30687*# Sheffield Univ. (England). Combustion Aerodynamics Research Lab.

DETAILED INVESTIGATION OF A VAPORISING FUEL SPRAY. PART 1: EXPERIMENTAL INVESTIGATION OF TIME AVERAGED SPRAY Progress Report

A. J. Yule, C. Ah Seng, R. Boulderstone, A. Ungut, P. G. Felton, and N. A. Chigier Jul. 1980 36 p refs

(Grant NsG-7517)

(NASA-CR-163483; CARL-IM-80-3) Avail: NTIS HC A03/MF A01 CSCL 20D

A laser tomographic light scattering technique provides rapid and accurate, high resolution measurements of droplet sizes, concentrations, and vaporization. Measurements using a computer interfaced thermocouple are presented and it is found that the potential exists for separating gas and liquid temperature measurements and diagnosing local spray density by in situ analysis of the response characteristics of the thermocouple. The thermocouple technique provides a convenient means for measuring mean gas velocity in both hot and cold two phase flows. The experimental spray is axisymmetric and has carefully controlled initial and boundary conditions. The flow is designed to give relatively insignificant transfer of momentum and mass from spray to air flow. The effects of (1) size-dependent droplet dispersion by the turbulence, (2) the initial spatial segregation of droplet sizes during atomization, and (3) the interaction between droplets and coherent large eddies are diagnosed. I.F.M.

N80-30688*# Tennessee Univ. Space Inst., Tullahoma.

FLOW VISUALIZATION STUDY OF SECONDARY FLOW IN A CORNER Final Report, 1 Jan. 1978 - 30 Jun. 1979

Frank G. Collins Dec. 1979 55 p refs

(Grant AF-AFOSR-3537-78; AF Proj. 2307)

(AD-A082634; AFOSR-80-0257TR) Avail: NTIS HC A04/MF A01 CSCL 20/4

An experimental investigation has been made of secondary flow in a 90 degree corner. The tests were run in a water tunnel at low speed (approximately 0.3 ft. per sec.) with emphasis on an attempt to visualize the embedded vortices in the laminar flow. The Reynolds number range was 11,000 to 52,500 per foot; the corner model was 9.75 in. wide by 48 in. long. The model was aligned in the tunnel so that no streamwise pressure gradient was present. Flow visualization was by means of hydrogen bubbles and dye. None of the streak-line examined with either the bubbles or the dye showed any indication of the presence of secondary motion in the first 18 inches of the corner. This is not believed to be conclusive since the vortices may exist at other distances along the corner (the limit here was imposed by the flow visualization apparatus used) or may be poorly developed in the initial length examined. GRA

N80-30689*# California Univ., Berkeley. Dept. of Mechanical Engineering.

APPLICATIONS OF RAYLEIGH SCATTERING TO TURBULENT FLOWS WITH HEAT TRANSFER AND COMBUSTION Final Report, 1 Mar. 1978 - 29 Feb. 1980

L. Talbot 6 May 1980 71 p refs

(Contract F44620-76-C-0083)

(AD-A086660; AFOSR-80-0535TR) Avail: NTIS HC A04/MF A01 CSCL 71/2

Rayleigh scattering has been developed as a diagnostic technique and used in conjunction with Laser Doppler Anemometry to study two reacting flows; the interaction of a Karman vortex street with a flame, and the interaction of grid-produced turbulence with a flame. It was found that one of the dominant effects of heat release and flow dilatation is to decrease turbulent kinetic energy, and to increase the integral scales of the turbulence. Flame holder drag is found to have a major effect on the flow-field behind the flame. The Markstein model for the effect of wrinkling on flame stability appears to be in qualitative agreement with the results of the vortex interaction experiments. GRA

N80-30690*# Pittsburgh Univ., Pa. Dept. of Mathematics and Statistics.

ANALYSIS OF NUMERICAL METHODS FOR THE EQUATIONS OF FLUID DYNAMICS Final Report

C. A. Hall and T. A. Porsching Jun. 1980 6 p refs

(Contract F49620-79-C-0100)

(AD-A086659; AFOSR-80-0543TR) Avail: NTIS HC A02/MF A01 CSCL 20/4

During the last twenty-five years, the published literature on computational fluid dynamics has grown enormously. However, there are few papers dealing with the analysis of computational methods for time dependent multidimensional flow. There also seems to be a polarization of investigators into two groups: advocates of finite difference methods and advocates of finite element methods. It is our contention that an 'ideal' computational model for fluid flow problems may in fact draw on the strengths of both schools of thought. For example, we have recently implemented a frontal solution technique, originally devised for finite element analyses, in a finite difference model of two-phase fluid flow. GRA

N80-30691*# Dayton Univ., Ohio. Research Inst.

THE STABILITY OF A COMPRESSIBLE FREE SHEAR LAYER Final Technical Report, Jan. - Sep. 1978

David F. Roscoe and Wilbur L. Hankey Oct. 1979 50 p refs

(Contract F33615-76-C-3145; AF Proj. 2307)

(AD-A086664; AFWAL-TR-80-306) Avail: NTIS HC A03/MF A01 CSCL 20/4

Inviscid flows with an inflection point in the velocity profile have been identified by Lord Rayleigh (1880) to be unstable. Michalke (1964) computed the amplification factors of the instability for a shear layer in incompressible flow. This report extends this work to include compressible flows. The results indicate large amplification rates occur through the transonic range but reduce drastically for supersonic flows. GRA

N80-30692*# Tel-Aviv Univ. (Israel). School of Engineering.

ON THE SPREADING RATE AND STRUCTURE OF A TURBULENT SPOT Final Report, 1 Mar. 1979 - 29 Feb. 1980

I. Wygnanski and J. Haritonidis (Univ. of Southern California, Los Angeles) 19 Mar. 1980 47 p refs Prepared for European Office of Aerospace Research and Development, London

(Grant AF-AFOSR-3275-77; AF Proj. 2307)

(AD-A086445; AFOSR-80-0472TR) Avail: NTIS HC A03/MF A01 CSCL 20/4

Velocity measurements in the plane of symmetry of a turbulent spot are reported. The number of data points taken at various streamwise locations was adequate to map the ensemble averaged flow field in a spot at a given instance. These results are compared to velocity taken in laboratory coordinates (i.e., at a given station with variable time), whereupon it is shown that the flow field in

the spot depends either on its distance from its origin or on the time elapsed from its initiation. The two variables are not independent, so the flow may be transformed into a time (space) independent problem. The dependence of the spot on the Reynolds number and on the surrounding laminar boundary layer is established. The effects of these parameters on the shape of the ensemble averaged spot, its size, characteristic celerities, and relative rate of entrainment, are discussed. GRA

N80-30693# Delaware Univ., Newark. Applied Mathematics Inst.

ON THE INITIATION OF DETONATIONS IN A ONE-DIMENSIONAL SYSTEM Interim Report

Robert P. Gilbert 1980 33 p refs

(Contract AF-AFOSR-2879-76; AF Proj. 2304)

(AD-A086713; TR-48A; AFOSR-80-0499TR) Avail: NTIS HC A03/MF A01 CSCL 19/4

The report is intended to provide Institute members with a concise discussion on the computation of the flow behind a shock leading to detonation in a one dimensional system. The computation would be performed using the method of characteristics, and this reduction would also be used later for our investigation of the stochastic initiation of detonations. Stochastic effects might be introduced either as white noise or as variations in material properties such as so-called 'hot spots'. Mathematically these effects would appear as part of the 'driving terms' in the characteristic formulation. Consequently the purpose of the present report is to be viewed primarily as a supportive document for our research effort on the stochastic initiation of detonation. GRA

N80-30694# Dayton Univ., Ohio.

SIMULATION OF VISCOUS STEADY FLOW PAST AN ARBITRARY TWO-DIMENSIONAL BODY Final Report, Aug. 1979 - Jan. 1980

Michele Napolitano Wright-Patterson AFB, Ohio AFFDL Feb. 1980 46 p refs

(Contract F33615-76-C-3145; AF Proj. 2307)

(AD-A086799; AFWAL-TR-80-3038) Avail: NTIS HC A03/MF A01 CSCL 20/4

A numerical technique is developed for solving laminar steady flow past an arbitrary two-dimensional body. A system of body oriented coordinates is first generated numerically by means of the transformation of Thompson et al. The vorticity-stream function Navier-Stokes equations are then solved by the Alternating Direction Implicit procedure of Douglas and Gunn. A relaxation-like time derivative is added to the stream function equation and the vorticity equation is linearized in time so that only the converged steady solution has physical meaning. Numerical results are presented for two model problems (a one dimensional Poiseuille flow and the driven cavity problem) and for flow past a NACA 0012 airfoil for moderate to high values of the Reynolds Number. Finally, advantages and limitations for the proposed algorithm are briefly addressed. GRA

N80-30695# General Applied Science Labs., Inc., Westbury, N. Y.

R2D2: A FORTRAN PROGRAM FOR TWO-DIMENSIONAL CHEMICALLY REACTING, HYPERTHERMAL, INTERNAL FLOWS. VOLUME 2: USER GUIDE Final Report, 15 May 1978 - 30 Sep. 1979

Gertrude Weilerstein, Robert Ray, Gabriel Miller, and John Erods Wright-Patterson AFB, Ohio AFFDL Jan. 1980 67 p refs 2 Vol.

(Contract F33615-78-C-3016; AF Proj. 2404)

(AD-A086762; GASL-TR-254-Vol-2; AFFDL-TR-79-3162-Vol-2) Avail: NTIS HC A04/MF A01 CSCL 09/2

Program R2D2, a FORTRAN program for finite difference solution of the unsteady equations of motion of an inviscid, chemically reacting and/or vibrationally excited mixture of gases in a two dimensional (planar or axisymmetric) duct, is described. The formulation and method of analysis has been outlined in Volume 1 of this report. The present volume describes the input, output, and operational procedures of the program. A summary flow chart of the main program is also presented, and the functions of all subroutines are outlined. Instructions for changing the thermochemical Block Data and the program dimensions are also presented. GRA

N80-30696# United Technologies Corp., East Hartford, Conn. Energy Conversion Systems Analysis Group.

TWO-PHASE NOZZLE THEORY AND PARAMETRIC ANALYSIS Technical Annual Report, 15 May 1979 - 14 May 1980

Simion C. Kuo and Charles W. Deane Jun. 1980 94 p refs

(Contract N00014-79-C-0344; RR0240302)

(AD-A086795; UTRC/R80-954624-2) Avail: NTIS HC A05/MF A01 CSCL 20/4

This study sought to formulate a working theory with which the performance of two phase nozzles can be analyzed parametrically over a wide range of flow conditions and fluid properties. As a basis for formulating the theory, the technical status of two phase nozzles was assessed, the governing flow parameters were identified, and the flow domains classified with the previously available theory. A working theory of two phase nozzles suitable for parametric analyzes and optimization was then formulated, incorporating the significant interphase effects of velocity slip, droplet breakup, and droplet heat transfer. Liquid/gas combinations for two phase nozzles, and suitable combinations for marine propulsion and other selected applications were discussed. Single phase (or homogeneous) theory was reviewed from the viewpoints of energy conversion in a nozzle and was compared with models applicable to separate phases in terms of their flow domains. Finally, a working theory of two phase nozzles was formulated based on the governing flow parameters and on six basic equations that described the two phase flow. From this theory, a computer model was developed which includes the significant interphase effects of velocity slip, droplet beakup, and heat transfer and which is suitable for parametric analysis and optimization. Preliminary parametric calculations based on use of this model were compared with results from previous two phase nozzle models and with available experimental data. GRA

N80-30697# Tennessee Univ., Tullahoma. Dept. of Aerospace and Mechanical Engineering.

UNSTEADY SWIRLING FLOWS IN GAS TURBINES Annual Technical Report, 1 Apr. 1979 - 31 Mar. 1980

M. Kurosaka May 1980 149 p refs

(Contract F49620-78-C-0045; AF Proj. 2307)

(AD-A086765; AFOSR-80-0509TR) Avail: NTIS HC A07/MF A01 CSCL 20/4

The objective of the investigation is to acquire fundamental understanding of a phenomenon characterized by violent fluctuations occurring in swirling air flows in aircraft engines; this flow instability, dubbed here as 'vortex whistle', is known to be capable of causing severe fatigue failure in gas turbine components. In the present report period, the analysis started from the compressible unsteady Navier-Stokes equations; this was necessary in order to assess the importance of the so-called higher order effects in the boundary layer upon the streaming. Resorting to the apparatus of a matched asymptotic expansion, the analytical representation of the acoustic streaming was derived anew. The results are in essential agreement with our previous conclusions and we were able to confirm, on firmer ground, the existence of the threshold swirl beyond which the free vortex distribution changes into a forced vortex type; these are written up in a paper form appended to this report. Second, based upon the analytical results, a test rig with two different tangential injection manifolds was designed, constructed and installed; the acquisition of the data from them will form the central effort of the next, Phase 2 activity. GRA

N80-30698# Naval Research Lab., Washington, D. C.

FINITE ELEMENT MODELING FOR CONVECTION-DIFFUSION PROBLEMS Interim Report

George A. Keramidas 15 May 1980 81 p refs

(RR023141)

(AD-A086777; AD-E000466; NRL-MR-4225) Avail: NTIS HC A05/MF A01 CSCL 20/13

The scope of this study is to develop the basic equations for deriving a finite element formulation which can be used to solve problems related to convection and diffusion dominated flows. The formulation is based on the introduction of a generalized quantity defined as heat displacement. The governing equation is expressed in terms of this quantity and a variational formulation is developed which leads to an equation similar in form to

Lagrange's equation of mechanics. This equation may be solved by any numerical method, though it is of particular interest for application of the finite element method. The developed formulation is used to derive two finite element models for solving convection-diffusion boundary value problems. The performance of the two element models is investigated and numerical results are given for different cases of conversion and diffusion with three types of boundary conditions. The numerical results obtained show not only the efficiency of the numerical models to handle pure convection, pure diffusion and mixed convection-diffusion problems but also good stability and accuracy. The applications of the developed numerical models is not limited to diffusion-convection problems but can also be applied to other types of problems such as mass transfer, hydrodynamics and wave propagation. GRA

N80-30698# Flow Research, Inc., Kent, Wash.
***VISUALIZATION STUDY OF TURBULENT SPOTS* Interim Technical Report, 1 May 1978 - 30 Apr. 1980**
Mohamed Gad-El-Hak and James J. Riley 1 May 1980 60 p refs
(Contract F49620-78-C-0062; AF Proj. 2307)
(AD-A086831; FLOW-RR-162; AFOSR-80-0473TR) Avail: NTIS HC A04/MF A01 CSCL 20/4

An investigation of turbulent spots evolving in a laminar boundary layer has been conducted during the period 1 May 1978 - 30 April 1980. A flat plate was towed through an 18 m water channel. The plate was mounted under a carriage that was towed at a constant velocity. The carriage rides on a continuously replenished oil film giving a vibrationless tow. Turbulent spots were initiated by a solenoid valve that ejected a small amount of water through a hole located downstream from the leading edge. A novel visualization technique has been employed that utilizes fluorescent dye excited by a sheet of laser. Some aspects of entrainment and structure of turbulent spots were inferred from the present experiments. In particular, the present results strongly suggest that another mechanism, in addition to entrainment, is needed to explain the lateral growth characteristics of the turbulent zone defining the spot. This mechanism, termed growth by destabilization, appears to be a result of the turbulence in the spot destabilizing the unstable laminar boundary layer in the neighborhood of the spot. Two additional tasks were carried out as part of this investigation. The first, a theoretical study of three-dimensional wave packets; and the second an investigation of the effects of drag reducing polymers and stratification on turbulent spots. GRA

N80-30700# Wisconsin Univ. - Madison. Mathematics Research Center.
***THE CONVERGENCE OF PERIODIC WAVES TO SOLITARY WAVES IN THE LONG WAVE LIMIT* Technical Summary Report**
J. F. Toland Mar. 1980 53 p refs Sponsored in part by United Kingdom Science Research Council
(Contract DAAG29-75-C-0024)
(AD-A086370; MRC-TSR-2054) Avail: NTIS HC A04/MF A01 CSCL 20/4

It is shown that large amplitude solitary water waves arise as the limit of periodic waves whose wavelengths increase indefinitely. This result is obtained after a new version of the Nekrasov integral equation for periodic waves has been derived. Its resemblance to the equation for solitary waves (i) leads to this convergence result once the global existence proof for solitary waves given in (1) has been taken into account. GRA

N80-30701# Illinois Univ. at Chicago Circle, Chicago.
RATE MEASUREMENT IN SHOCK WAVES WITH THE LASER-SCHLIEREN TECHNIQUE
J. H. Kiefer and J. C. Hajduk 1979 14 p refs Presented at 12th Intern. Symp. on Shock Tubes and Waves, Jerusalem, Aug. 1979
(Contract ER-78-S-02-4759)
(COO-4759-2; CONF-7908112-1) Avail: NTIS HC A02/MF A01

The laser schlieren or narrow laser beam deflection technique is discussed with particular reference to its application to very fast processes. The optics of the beam shock wave interaction is then examined by use of the scalar formulation of Huygens' principle (Kirchoff integral), with the shock density profile introduced as a transmission coefficient. The accuracy with which the signal generated by a differential detector will reproduce the variation of the refractive index gradient in a reactive shock is discussed in terms of this formulation. The response of such a detector to passage of a curved shock in a rare gas is also determined with the aid of the shock curvature theory of de Boer. These calculations are in good agreement with experiment and locate the time origin, coincidence of shock leading edge and beam center, on the positive portion of the signal near zero-crossing, an assignment that is in disagreement with the earlier calculations of Dove and Teitelbaum. DOE

N80-30702# California Univ., Livermore. Lawrence Livermore Lab.
FINITE ELEMENT SIMULATIONS OF THERMALLY INDUCED CONVECTION IN AN ENCLOSED CAVITY
C. D. Upson, P. M. Gresho, and R. L. Lee Mar. 1980 37 p refs
(Contract W-7405-eng-48)
(UCID-18602) Avail: NTIS HC A03/MF A01

The simulations reported establish benchmark comparisons of different techniques of solving the Navier-Stokes and thermal energy equations for a particular thermally driven flow. Also included is a brief analysis of the results and some comparisons with previous solutions. The second section of this paper contains a result at a higher Rayleigh number and some tilted cavity results, performed, in part, as potential candidates for more difficult followup benchmark problems. DOE

N80-30703# Los Alamos Scientific Lab., N. Mex.
NOVEL APPROACH TO THE COMPUTATION OF AXISYMMETRIC COUNTERCURRENT PATTERNS IN GAS CENTRIFUGES
L. D. Cloutman Feb. 1980 34 p refs
(Contract W-7405-eng-36)
(LA-8258-MS) Avail: NTIS HC A03/MF A01

A numerical algorithm based on finite Fourier Chebyshev transforms for solving the total reflux, thermal drive centrifuge problem is presented. The method should be capable of providing steady state solutions with excellent resolution in a few minutes of computer time. The same technique may be easily applied to other problems, including the isotope diffusion equation. A simple diffusion equation is solved to show certain aspects of the numerical method, in particular, its excellent convergence properties. DOE

N80-30704# Nevada Univ., Las Vegas. Desert Research Inst.
THERMODYNAMIC RELATIONS BETWEEN SELECTED PARAMETERS DESCRIBING UNSATURATED FLOW
Clinton M. Case May 1980 47 p refs
(Contract DE-AC08-76DP-01253)
(DOE/DP-01253/18; DRIP-4501B) Avail: NTIS HC A03/MF A01

The first law of thermodynamics is applied to unsaturated flow by replacing the usual PdV term (P is pressure and V is volume) for a chemical system which appears there by phi d theta sub s (phi is matric suction and theta sub s is the degree of saturation). If the assumption is made that hysterectic behavior of the moisture characteristic can be ignored, all the usual thermodynamic relations can be derived in which P is replaced by phi and V is replaced by theta sub s and the various thermodynamic potentials, internal energy, U, entropy, S, and so on, are understood to be normalized to unit void volume of the soil being considered. This leads to a thermodynamically derived theoretical expression for the slope of the teristic in terms of theta sub s temperature, T, and the thermal expansivity of water, beta sub 1. DOE

N80-30705# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France). Div. Systemes Balistiques et Spatiaux.
A COMPUTER PROGRAM FOR TRANSIENT AND AXISYMMETRIC ABLATION, CONDUCTION AND RADIATION
L. Fusade and A. Rivas 1979 11 p Presented at Intern. Conf. on Numerical Methods in Thermal Probl., Swansea, England, 2-6 Jul. 1979
(SNIAS-792-422-120) Avail: NTIS HC A02/MF A01

Multidimensional characteristics of heat conduction and ablation, associated with high thermal fluxes encountered by heat shielding on space vehicles and ballistic missiles during atmospheric reentry, are modeled theoretically, then implemented in a computer program. This program allows analysis and design of axisymmetric bodies, taken into account two input parameters (for the heat shielding material), mass transfer coefficient and heat of ablation, as functions of pressure and temperature. Thermo-mechanical erosion is computed empirically, including surface roughness effects. Author (ESA)

N80-30706# Technische Hogeschool, Delft (Netherlands). Lab. for Thermal Power Engineering.

FUNDAMENTAL INVESTIGATION OF INTERACTION FORCES IN BUBBLE SWARMS AND APPLICATION TO THE DESIGN OF CENTRIFUGAL SEPARATORS Ph.D Thesis

R. Wisman May 1979 349 p refs
(WTHD-115) Avail: NTIS HC A15/MF A01

Rotating gas-liquid flows were investigated, both experimentally and during the development of a numerical description. The interaction forces in bubble swarms were observed, resulting in correlations for the drag force and virtual mass coefficients. The validity of these correlations was verified using first, atmospheric air-water mixtures, then high pressure steam water mixtures. Applicability to the numerical solution of the momentum balances is shown. A computer procedure (ANALEST) for computation of rotating gas liquid flows, based on differential mass and momentum balances, was developed. Eight flow variables were identified but only seven could be computed. The results were used in the design and testing of a venturi separator for nuclear boiling water reactors. Design rules were provided to translate the separating effect obtained with this reduced scale separator to an upscaled version. Author (ESA)

N80-30707# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).

TRANSFORMATION OF A DROP FALLING ON THE SURFACE LAYER OF A LIQUID IN A VORTEX RING [UMBILDUNG EINES FALLENDEN TROPFENS AN DER OBERFLAECHE EINER FLUESSIGKEITSSCHICHT IN EINEN RINGWIRBEL]

Peter E. M. Schneider Aug. 1979 128 p refs In GERMAN
(MPIS-15/1979; ISSN-0436-1199) Avail: NTIS HC A07/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 35.30

The vortex which is formed when a drop falls on the surface layer of a liquid was studied. The factors involved in the formation of this vortex were examined with particular emphasis on drop radius, height of the drop fall, depth of the liquid, and the physical qualities of the drop and of the liquid. R.C.T.

N80-30708# Hochschule der Bundeswehr, Munich. (West Germany). Fachbereich Luft- und Raumfahrttechnik.

OSCILLATIONS OF A LIQUID WITH A FREE SURFACE IN A WEDGE SHAPED CONTAINER [FLUESSIGKEITS-SCHWINGUNGEN MIT FREIER OBERFLAECHE IN KEIL-FOERMIGEN BEHAELTERN]

Helmut F. Bauer 1979 62 p refs In GERMAN
(HSBW-FB-LRT-WE-9-4-79) Avail: NTIS HC A04/MF A01

The natural frequencies of a frictionless and incompressible liquid with a free surface in a wedge shaped containers with a small opening angle are determined. Results indicate that it is possible to determine the pressure distribution, surface distortion, liquid forces and moments from the speed potential. The natural frequencies of several containers measured in the experiment confirm the theoretical values. Author (ESA)

N80-30709# Poitiers Univ. (France).

DEVELOPMENT OF A THERMAL MODEL LIBRARY: APPLICATION TO DYNAMIC SIMULATION OF THERMAL CONTROL FOR SPACELAB FLUID LOOPS Final Report [DEVELOPPEMENT D'UNE BIBLIOTHEQUE DE MODELES THERMIQUES: APPLICATION A LA SIMULATION DYNAMIQUE DU CONTROLE THERMIQUE DES BOUCLES DE FLUIDES DE SPACELAB]

J. B. Saulnier, A. Alexandre, and J. Martinet Oct. 1979 121 p refs In FRENCH; ENGLISH summary
(Contract ESTEC-3615/78-NL-AK)
(ESA-CR(P)-1302) Avail: NTIS HC A06/MF A01

The analogies between thermal and electrical parameters were extended, and electrical network analysis methods applied to thermal problems (including active thermal control). A library of thermal models was developed using ASTEC 3, and applied to some dynamic simulations of the environmental control fluid loops of SPACELAB. Author (ESA)

N80-30710# Societe Anonyme Belge de Constructions Aeronautiques, Brussels (Belgium).

DIODE BEHAVIOR Final Report

Dec. 1979 88 p refs
(Contract ESA-3737/78)
(ESA-CR(P)-1319) Avail: NTIS HC A05/MF A01

The diode behavior of a gas controlled variable conductance heat pipe (VCHP) was studied. A literature search was made covering the various heat pipe control functions and techniques, along with the state-of-the-art for diode operation. The diode operation limits and characteristics were predicted for the AH95 type VCHP and a technique evolved to extend the diode operation limit. One AH95 VCHP was tested and improved to obtain a better diode capability. A comparison was made between the liquid trap and gas blockage diode techniques. Author (ESA)

N80-30711# Societe Anonyme Belge de Constructions Aeronautiques, Brussels (Belgium).

CRYOGENIC HEAT PIPES, PHASE 1 REPORT

Dec. 1979 55 p refs
(Contract ESA-3737/78)
(ESA-CR(P)-1323) Avail: NTIS HC A04/MF A01

The use of small diameter heat pipes using ammonia as a heat carrier was investigated for space applications. An initial analysis and literature search determined the most promising power levels. Experimentation with 3 mm pipes working with ethane and methane confirmed their potentiality as to the power level, tilting capability, integration flexibility, and resistance to adverse environments. Author (ESA)

N80-30712# European Space Agency, Paris (France).

CALCULATIONS OF FREE TURBULENT SHEAR FLOW WITH A THREE EQUATION TURBULENCE MODEL BY J. C. ROTTA

Eberhard Meineke Apr. 1980 65 p refs Transl. into ENGLISH of "Berechnung Freier Turbulenter Scherstroemungen mit einem 3-Gleichungs-Turbulenzmodell von J. C. Rotta", Rept. DLR-FB-77-60 DFVLR, Goettingen, West Germany
(ESA-TT-525; DLR-FB-77-60) Avail: NTIS HC A04/MF A01; DFVLR, Cologne DM 26.10

Calculations were made using a system of partial differential equations which describe plane and axisymmetric turbulent flows at high Reynolds numbers. This system includes three equations to describe turbulent field quantities in addition to the two equations for the longitudinal and cross flow component of the mean flow. These are the equation for the kinetic energy of fluctuations, the equation for a characteristic length scale, and the transport equation for the Reynolds shear stress. After the necessary closure assumptions, which contain only empirically determinable coefficients, the equations form Rotta's turbulent model. The equations were numerically solved for three cases of free shear flow and the influence of the coefficients of the shear stress transport equation on the solution was studied. A single set of coefficients is given, for which the calculated flow cases are found in satisfactory agreement with experimental results. Author (ESA)

N80-30713# European Space Agency, Paris (France).

FLOW PHENOMENA IN GRAVITATIONLESS MELTING ZONES IN THE PRESENCE OF ELECTROMAGNETIC FIELDS

Chung-Hwang Chun Jan. 1980 63 p refs Transl. into ENGLISH of "Stroemungsvorgaenge in Schwerelosen Schmelzzonen bei Anwesenheit Elektromagnetischer Felder", Rept. BMFT-FB-W-77-42 Technische Univ., Hanover, Dec. 1977 Original report in GERMAN previously announced as N79-30528
(ESA-TT-592; BMFT-FB-W-77-42) Avail: NTIS HC A04/MF A01; ZLDI, Munich DM 14.70

Under the condition of zero-gravity the convection in a melting zone, caused by the gradient of surface tension

(Marangoni-convection), influences substantially the process of crystal growth. It may be influenced by application of electromagnetic fields. An analysis of the significant forces leads to the characteristic number of similarity and to the classification of the melting flow with regard to the efficiency of the electromagnetic forces. The Marangoni-convection and its influence by means of magnetic fields in the cylindrical melting zone of silicon were studied numerically. From the results the temperature and velocity fields with and without the magnetic field can be predicted and compared. The basis is provided for systematic studies of the optimal flow and temperature conditions for crystal growth.
Author (ESA)

N80-30714# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
OPTIMIZATION OF A ROTATING THERMALLY CONDUCTING JOINT AND INCORPORATION IN A LABORATORY MODEL DEPLOYABLE RADIATOR Final Report
B. Hinderer Mar. 1980 113 p
(Contract ESTEC-3765/78-NL-PP)
(DS-190-0-78; ESA-CR(P)-1337) Avail: NTIS HC A06/MF A01

A thermal and mechanical optimization of a thermally conducting joint and an attached heat pipe radiator was performed. A thermal node model was established to calculate different design configurations. The sealing-bearing concept was redesigned to minimize torque. Axially grooved heat pipe profiles were established for the design goal of this deployable radiator model. An engineering model deployable radiator was constructed and submitted to a thermal-vacuum test. Temperature drops from feeder to radiator closely met predictions, but measured torque exceeded expectations but was within an acceptable range for space applications. The heat pipe network comprising the heat pipes of the radiator and those integrated in the rotor profile was not entirely satisfactory. Evaluation of the results of thermal-vacuum test and previous heat pipe tests led to no definite explanation for the problems with some of the radiator heat pipes.
Author (ESA)

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N80-30715 Cincinnati Univ., Ohio.
A HOLOGRAPHIC INTERFEROMETRIC STUDY OF THE TEMPERATURE DEPENDENCE OF DIFFUSION OF AQUEOUS SODIUM CHLORIDE IN WATER, FROM 32 C TO 50 C Ph.D. Thesis
Gray Gabelmann 1980 67 p
Avail: Univ. Microfilms Order No. 8021033

The detection of an apparent second order phase transition in bulk water structure in tetramethylammonium chloride solutions by proton nuclear magnetic resonance spectroscopy was reported. Measurements indicated that the entropic increase with temperature is continuous but a discontinuity appears in the first derivative at about 42 C. This discontinuous behavior of the chemical shift of bulk water protons suggests the existence of a second order phase change in the water structure (a biphasic change). Such a phase change must be characterized by changes in the structure of the liquid. The thermodynamic variables that show a discontinuity during such a phase change are monitored directly. A change in volume, for example, will cause a change in density which will alter the vaporization energy of a liquid. The diffusion constant is closely related to the vaporization energy, so as the diffusion constant is monitored, changes in the density are detected. Any biphasic behavior should be seen as a change in the temperature dependence of the diffusion constant for the system. The diffusion constant for the diffusion of aqueous NaCl into H2O over the temperature range 32 C to 50 C using holographic interferometry was measured. The interferograms were analyzed using a method recently developed.
Dissert. Abstr.

N80-30716*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MARS 1414 RECORDER ENVIRONMENTAL TESTS
David Langjahr Aug. 1980 31 p
(NASA-TP-1709; Rept-80F5124) Avail: NTIS HC A03/MF A01 CSCL 14E

Environmental testing is described and the data of the Modular Airborne Recording System (MARS) 1414 is presented. The preliminary data marks a starting point for more complete thermal testing in the future. The unit was operated at +/-55 C at one atmosphere, -10 C at 75,000 feet (28 mm Hg)at the other. Temperatures at 13 locations on the unit were monitored and plotted against elapsed time. From the test results, some estimation can be made of ambient temperatures in which the heaters will operate and shut off. This data is sufficient to complete a preliminary analysis of the MARS 1414 Recorder, and to design further tests.
R.K.G.

N80-30717*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DIAL WITH HETERODYNE DETECTION INCLUDING SPECKLE NOISE: AIRCRAFT/SHUTTLE MEASUREMENTS OF O3, H2O, AND NH3 WITH PULSED TUNABLE CO2 LASERS
Philip Brockman, Robert V. Hess, Leo D. Staton, and Clayton H. Bair Aug. 1980 14 p refs Presented at Intern. Conf. on Heterodyne Systems and Technol., Williamsburg, Va. 25-27 Mar. 1980 Submitted for publication
(NASA-TP-1725; L-13876) Avail: NTIS HC A02/MF A01 CSCL 20E

Atmospheric trace constituent measurements with higher vertical resolution than attainable with passive radiometers are discussed. Infrared differential absorption lidar (DIAL), which depends on Mie scattering from aerosols, has special advantages for tropospheric and lower stratospheric applications and has great potential importance for measurements from shuttle and aircraft. Differential absorption lidar data reduction involves comparing large amplitude signals which have small differences. The accuracy of the trace constituent concentration inferred from DIAL measurements depends strongly on the errors in determining the amplitude of the signals. Thus, the commonly used S/NR expression (signal divided by noise in the absence of signal) is not adequate to describe DIAL measurement accuracy and must be replaced by an expression which includes the random coherent (speckle) noise within the signal. A comprehensive DIAL computer algorithm is modified to include heterodyne detection and speckle noise. Examples for monitoring vertical distributions of O3, H2O, and NH3 using a ground-, aircraft-, or shuttle-based pulsed tunable CO2 laser DIAL system are given.
R.K.G.

N80-30718# Aeronautical Research Labs., Melbourne (Australia).
CALIBRATION OF A STRAIN-GAUGED CT4-A UNDERCARRIAGE
V. Romeo Jan. 1980 62 p refs
(AD-A086965; ARL/STRUC-TM-308) Copyright. Avail: NTIS HC A04/MF A01 CSCL 01/3

This memo presents the basic equations required to relate strains to components of flight and landing loads acting on CT4-A undercarriage legs. Details of strain gauge locations are contained in ARL Drawing No. 53432 and photographs and details of the test rig are included. The results of the calibration in February 1977 are recorded with details of the subsequent analysis. The application to flight test data is also described.
GRA

N80-30719# Aeronautical Research Labs., Melbourne (Australia).
ANALYSIS OF GROUND CALIBRATION DATA FROM STRAIN GAUGES ATTACHED TO THE AIRFRAME OF CT4-A AIRTRAINER A19-031
M. G. J. Higgs Aug. 1979 39 p
(AD-A086970; ARL/STRUC-TM-296) Copyright. Avail: NTIS HC A03/MF A01 CSCL 01/3

A CT4A Airtrainer airframe was subjected to wing bending, wing torque, fin loading and tailplane loading. The resulting strains are analyzed.
GRA

N80-30720# Eastman Kodak Co., Rochester, N. Y.
OPTICAL POWER SPECTRUM ANALYZER. SCANNING LASER BEAM SYSTEM PERMITS FULL FORMAT COVERAGE Final Report
S. C. Arnold and D. J. Josephson 17 Dec. 1979 24 p
(Contract DACA76-78-C-0003)
(AD-A087047; ETL-0214) Avail: NTIS HC A02/MF A01 CSCL 14/2

On 18 April 1978, Eastman Kodak Company was awarded a contract to design, fabricate, test, deliver and install an Optical Power Spectrum Analyzer (OPSA). The contract defines a design and fabrication effort intended to draw upon developed technology for its operating principles. This final report therefore deals with the results of final acceptance testing and how the final performance test data compares with initial design requirements. GRA

N80-30721# National Technical Information Service, Springfield, Va.
SCHLIEREN AND SHADOWGRAPH PHOTOGRAPHY. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1976 - Mar. 1980
Guy E. Habercom, Jr. Apr. 1980 186 p Supersedes NTIS/PS-79/0502; NTIS/PS-78/0411
(PB80-809775; NTIS/PS-79/0502; NTIS/PS-78/0411) Avail: NTIS HC $30.00/MF $30.00 CSCL 14E

A bibliography of 179 abstracts covering the applications and techniques of Schlieren and shadowgraphy photography is presented. The majority of the reports are primarily concerned with flow visualization, although there are included studies on heat transfer and combustion processes. GRA

N80-30322*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DIGITAL RECORDING ACQUISITION SUBSYSTEM FOR RADIO INTERFEROMETRY APPLICATIONS IMPLEMENTATION PLAN
V. B. Kapoor *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 9-14 (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 14E

36 LASERS AND MASERS

Includes parametric amplifiers.

N80-30722 California Inst. of Tech., Pasadena.
THE MODE LOCKED DYE LASER. 1. PICOSECOND PHOTOCONDUCTIVITY OF SEMI-INSULATING GALLIUM-ARSENIDE, 2 Ph.D. Thesis
Richard Harrison Moyer 1980 135 p
Avail: Univ. Microfilms Order No. 8020426

The principles and practice of the passive mode locking of a CW dye laser are discussed with emphasis on the dynamics of picosecond pulse production as well as the techniques of high resolution pulse width measurement. The characterization of the mode locked dye laser through real time temporal and spectral measurements is also described. The development and applications of the opto-electronic semiconductor switch are considered. Design considerations of the high speed photoconductive device and results of experiments in which picosecond pulses activate the devices are discussed. The experimental results are interpreted to yield numerical estimates of carrier recombination rates. An experimental technique for determining these parameters through ultrafast magnetophotoconductivity is introduced as well. Results show good agreement with the steady state measurements. Dissert. Abstr.

N80-30723 California Inst. of Tech., Pasadena.
THEORY OF THE LONGITUDINAL FREE ELECTRON LASER, 1. A THEORETICAL MODEL OF THE LINEAR ELECTROOPTIC EFFECT, 2 Ph.D. Thesis
Chun-Ching Shih 1980 202 p
Avail: Univ. Microfilms Order No. 8019907

A proposed longitudinal free electron laser is described in which simulated by a relativistic electron beam passing through a periodically corrugated waveguide. The wavelength of the radiation is widely tunable by changing the electron energy. Theoretical investigations are based on the single electron analysis. Both linear and nonlinear treatments of the laser mechanism in a free electron laser are carried out analytically. The phenomena of homogeneous and inhomogeneous interactions lossy gain, space charge effect, large signal behavior, large gain amplification, and electron dynamics are discussed. A one energy gap model, dielectric theory, and the concept of bond charge were used to investigate the linear Pockel's effect. A general expression is obtained for the electrooptic coefficient of a crystal and is applied to the calculation for diatomic and ternary compounds. The results are generally in good agreement with the measured values for nearly all the crystals in which the electrooptic coefficient had been determined. Dissert. Abstr.

N80-30724 Southern Methodist Univ., Dallas, Tex.
MODELING, SIMULATION, AND CONTROL OF A CLOSED CYCLE LASER GAS SUPPLY SYSTEM Ph.D. Thesis
Stephen Kent Vernon 1980 120 p
Avail: Univ. Microfilms Order No. 8019073

Patel's concept of passing laser gas through a cavity to prevent a heat build up is studied. The flow system used is the closed cycle or circulator type where the gas is contained in a ductwork system to be circulated by a turbine and cooled by heat exchangers. The first step in solving this problem is to model the system, which is done with component models and conservation equations. Once the model is complete, the system can be simulated on a digital computer. Two different models are presented with the first a fourteenth order model and the second a fifth order model. Simulation results for both models are given. The heat exchanger controller is designed using the heat exchanger model in stand alone fashion. The pressure controller is designed using an eighth order linearized circuit model. The control system designs are then tested using the fourteenth order simulation program. Dissert. Abstr.

N80-30725 Polytechnic Inst. of New York.
ANALYSIS OF THE COPPER VAPOR LASER AND DEVELOPMENT OF A GENERAL LASER PLASMA MODEL Ph.D. Thesis
George Michael Kull 1980 156 p
Avail: Univ. Microfilms Order No. 8019401

Excellent qualitative and quantitative agreement between modeled and experimental results clarified the important processes involved in the copper vapor laser. These processes are: radiation trapping, stepwise excitation, cavity loss factors, and electron collisional excitation of the lower and upper laser levels. To accomplish this comparison a general model for a pulsed gas discharge laser was developed and applied to the copper vapor laser. An iterative implicit method of solution is used. All nonlinear coefficients are represented as rational functions. The lowest five levels and three higher excited levels of neutral atomic copper plus the singly ionized copper ground level were included in the model as well as the neutral and singly ionized ground states of the buffer gas. When the three higher excited levels were removed, the output laser pulse widened indicating that stepwise excitation to these additional levels plays a role in the laser kinetics. Semiclassical excitation cross sections of the Gryzinski-type were compared with impact parameter cross sections. Dissert. Abstr.

N80-30726*# Rensselaer Polytechnic Inst., Troy, N. Y. School of Engineering.
REAL-TIME OPERATING SYSTEM FOR A MULTI-LASER/MULTI-DETECTOR SYSTEM
Gary Coles Jul. 1980 120 p refs
(Grant NsG-7369)
(NASA-CR-163486; RPI-TR-MP-65) Avail: NTIS HC A06/MF A01 CSCL 20E

The laser-one hazard detector system, used on the Rensselaer Mars rover, is reviewed briefly with respect to the hardware subsystems, the operation, and the results obtained. A multi-detector scanning system was designed to improve on the original system. Interactive support software was designed and programmed to implement real time control of the rover or platform with the elevation scanning mast. The formats of both the raw data and the post-run data files were selected. In addition, the

interface requirements were selected and some initial hardware-software testing was completed. E.D.K.

N80-30727*# Cincinnati Univ., Ohio.
NUCLEAR ISOMER SUITABLE FOR GAMMA RAY LASER Final Technical Report, 15 Jan. 1977 - 31 May 1979
Shacheenatha Jha 31 May 1979 16 p refs
(Grant NsG-3091)
(NASA-CR-163482) Avail: NTIS HC A02/MF A01 CSCL 20E

The operation of gamma ray lasers (gasers) are studied. It is assumed that the nuclear isomers mentioned in previously published papers have inherent limitations. It is further assumed that the judicious use of Bormann effect or the application of the total external reflection of low energy gamma radiation at grazing angle of incidence may permit the use of a gaser crystal sufficiently long to achieve observable stimulated emission. It is suggested that a long lived 0(+) isomer decaying by low energy gamma ray emission to a short lived 2(+) excited nuclear state would be an attractive gaser candidate. It is also suggested that the nuclear isomer be incorporated in a matrix of refractory material having an electrostatic field gradient whose principal axis lies along the length of the medium. This results in the preferential transmission of electric quadrupole radiation along the length of the medium. E.D.K.

N80-30728# Illinois Univ. at Urbana-Champaign. Electro-Physics Lab.
OPTICALLY PUMPED FAR INFRARED MOLECULAR LASERS Final Report, 1 Feb. 1976 - 31 Jan. 1980
Paul D. Coleman Apr. 1980 138 p refs
(Grant AF-AFOSR-2988-76; AF Proj. 2301)
(AD-A086495; UILU-ENG-80-2540; AFOSR-80-0441TR) Avail: NTIS HC A07/MF A01 CSCL 20/5

This report summarizes studies on optically pumped far infrared molecular gas lasers. The research has been concerned with the general subjects of far infrared integrated optics and technology, the discovery of new optically pumped molecular laser systems, and the study and analysis of nonlinear processes (Raman and hyper-Raman) that can occur in optically pumped systems. The theoretical density matrix analysis of the gain spectra of nonlinear systems and the first detailed experimental measurements of these systems are presented. It is demonstrated that third and fifth order nonlinear processes can exceed first order laser processes. An experimental study of the generation of a 22.653 GHz signal (the largest wavelength yet reported) in optically pumped NH3 is described. The frequency tunability and single shot spectral characteristics of the signal were measured with precision. A single laser pump in a four-level system can yield two laser signals, which in the linear case are not coupled together. However, with stronger pumping, nonlinear effects can couple the two laser signals with the result that the behavior of one laser signal is determined by the other and vice versa. The self-consistent analysis of this problem is described. GRA

N80-30729# Advanced Research and Applications Corp., Sunnyvale, Calif.
A STUDY OF LOW-TEMPERATURE PROCESSES IN NON-EQUILIBRIUM ELECTRONIC STATES Final Report, Feb. 1978 - Jan. 1980
T. C. Wang, T. J. Magee, J. Peng, and R. A. Armistead Apr. 1980 58 p refs
(Contract F49620-78-C-0010; AF Proj. 2301)
(AD-A086494; AFOSR-80-0467TR) Avail: NTIS HC A04/MF A01 CSCL 20/5

Primary focus was directed to experimental studies of the electrical behavior of weakly-coupled superconductors. Two types of superconducting devices were used, Josephson tunnel junctions and superconducting thin-film microbridges. The experiments showed that non-equilibrium states created by microwave irradiation and quasiparticle injection will change the current voltage characteristics of Josephson devices. Experiments were also conducted to determine if the grain size of superconducting niobium (Nb) films could be controlled using scanning laser annealing. Initial (as deposited) grain sizes were dependent upon the deposition technique. Regardless, laser annealing resulted in substantial modifications to the structure of the Nb films. With proper laser annealing techniques, relatively fine-grained polycrystalline films were converted to large polycrystalline grains with an average size of 5 by 10 micrometers. GRA

N80-30730# Rochester Univ., N. Y. Lab. for Laser Energetics.
DEVELOPMENT OF X-RAY LASER MEDIA: MEASUREMENT OF GAIN AND DEVELOPMENT OF CAVITY RESONATORS FOR WAVELENGTHS NEAR 130 ANGSTROMS Annual Report, 1 Nov. 1978 - 31 Dec. 1979
James M. Forsyth Feb. 1980 36 p refs
(Grant AF-AFOSR-3189-77)
(AD-A086670; AFOSR-0503-80TR) Avail: NTIS HC A03/MF A01 CSCL 20/5

A new experimental facility was used to explore a range of conditions under which inverted populations on soft X-ray transitions could be produced in laser heated plasmas. Direct measurements with grating spectrographs were performed in the vicinity of 130 angstroms to develop the diagnostic techniques for gain determination. Designs for reflectors suitable for use in cavity resonators at soft X-ray wavelengths were developed. Construction of apparatus to produce such reflectors was begun. A patent on the reflector design was applied for. GRA

N80-30731# United Technologies Research Center, East Hartford, Conn.
CALCULATION OF THE ENERGETICS AND COLLISION DYNAMICS OF ELECTRONIC TRANSITION LASERS Final Report, 1 Apr. 1977 - 31 Mar. 1980
H. Harvey Michaels and R. H. Hobbs May 1980 55 p refs
(Contract F49620-77-C-0064; AF Proj. 2303)
(AD-A086657; UTRC/R80-922853; AFOSR-80-0537TR) Avail: NTIS HC A04/MF A01 CSCL 20/5

This research develops techniques and computational schemes for a priori prediction of the kinetics and the product distribution of atom/diatom reactions. This involves (1) improved calculation techniques for potential energy surfaces for the reactants and products; (2) quantum and classical mechanical calculations of the dynamics of the reaction; and (3) detailed calculations for systems with high potential as electronic transition lasers. GRA

N80-30732# Georgia Inst. of Tech., Atlanta. School of Physics.
CROSS SECTIONS FOR IONIZATION OF RARE GAS EXCIMERS BY ELECTRON IMPACT AND ATOMIC AND MOLECULAR PROCESSES IN EXCIMER LASER Final Report, 1 Apr. 1978 - 30 Sep. 1979
M. Raymond Flannery and K. J. McCann Mar. 1980 121 p refs
(Contract F33615-78-C-2028; AF Proj. 2301)
(AD-A086698; AFWAL-TR-80-2015) Avail: NTIS HC A06/MF A01 CSCL 20/5

Theoretical cross sections for ionization of metastable excimers: helium, neon, argon, krypton and zenon, and of metastable mercury are presented. Systematic trends in inelastic form factors and Born cross sections for collisional transitions between excited neighboring levels of atoms are discovered and discussed. Key cycles of atomic and molecular collision processes in excimer lasers are delineated and discussed. GRA

N80-30733# Battelle Columbus Labs., Ohio.
QUANTUM MECHANICAL STUDIES OF MOLECULAR HYPERPOLARIZABILITIES Final Technical Report
30 Apr. 1980 68 p refs
(Contract F49620-78-C-0046)
(AD-A086662; AFOSR-0466-80TR) Avail: NTIS HC A04/MF A01 CSCL 20/5

The objectives of this effort are threefold: develop state-of-the-art quantum mechanical methods to predict, from first principles, hyperpolarizabilities of atoms and molecules; determine why previous theoretical calculations have not been able to even provide order of magnitude estimates of experimental hyperpolarizabilities; and apply the quantum mechanical techniques developed in this work to predict hyperpolarizabilities and non-linear susceptibilities for a number of atoms and molecules of interest. This effort will provide complementary information to on-going experimental efforts directed toward obtaining hyperpolarizabilities. GRA

N80-30734# Toronto Univ., Downsview (Ontario). Inst. for Aerospace Studies.
STUDIES OF LASER SELECTIVE EXCITATION OF ATOMS
Norbert Drewell Dec. 1979 152 p refs
(Grant AF-AFOSR-2902-76)
(AD-A086497; UTIAS-229; AFOSR-80-0507TR) Avail: NTIS HC A08/MF A01 CSCL 17/4

Sample preparation through laser ablation of a solid target under vacuum has been combined with short-pulsed laser selective excitation to create a new and convenient experimental technique for measuring atomic radiative lifetimes. The lifetimes of the three resonance states of chromium determined in this way compare very favourably with those found through other experimental means. In addition, the technique has been extended to demonstrate experimentally the potential for plasma diagnostics using two-wavelength selective excitation with short laser pulses. The ratio of population densities of two energy states of chromium atoms has been measured as a function of time during the expansion of the ablation plasma. Extended saturation pumping of the resonance transition in sodium vapour has been investigated theoretically. Rate equations for 20 energy levels in the sodium atom, and the rate equations for the free electrons, were integrated numerically. It has been found that multiphoton ionization, combined with superelastic heating of free electrons can account for the rapid and complete ionization of an un-ionized vapour, as reported in the literature. The detailed theoretical results have led to the development of a simple model which accurately predicts the temporal variation of electron density. GRA

N80-30735# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.
INVERSION OF SPECTRAL LINESHAPES TO YIELD COLLISIONAL RATE CONSTANTS Status Report, 1 Sep. 1978 - 31 Aug. 1980
J. Gelfand, H. Rabitz, and R. B. Miles 1 Jun. 1980 13 p refs
(Contract N00014-78-C-0721)
(AD-A086347; SR-1) Avail: NTIS HC A02/MF A01 CSCL 07/4

State-to-state collisional energy transfer rates are being obtained by the inversion of pressure broadened linewidth data. Measurements of linewidths in overtone vibration-rotation transitions have yielded information rotationally elastic and inelastic collision rates for vibrationally excited HCl. Work is continuing in acquiring similar information for vibrationally excited HF and DF using tunable laser photoacoustic spectroscopy. GRA

N80-30736# Naval Surface Weapons Center, White Oak, Md. Research and Technology Dept.
INFLUENCE OF WALL IMPEDANCE ON THE ELECTRON CYCLOTRON MASER INSTABILITY Final Report
Han S. Uhm 1 Mar. 1980 50 p refs
(ZR01109)
(AD-A086401; NSWC/TR-80-131) Avail: NTIS HC A03/MF A01 CSCL 20/5

The influence of finite wall impedance effects on the cyclotron maser instability of a hollow electron beam is investigated. The stability analysis is carried out within the framework of the linearized Vlasov-Maxwell equations, assuming that the beam thickness is much less than the radius of the beam. The formal dispersion relation for azimuthally symmetric electromagnetic perturbations is obtained, including the influence of an arbitrary value of wall impedance. One of the most important features of this analysis is that, for a purely resistive wall, the growth rate of instability is substantially reduced by allowing even a very small amount of resistivity. Moreover, the range of axial wave-numbers corresponding to instability increases rapidly as the wall resistivity is increased. Cyclotron maser stability properties in a dielectric loaded waveguide is also investigated. It is shown that by an appropriate choice of the dielectric constant epsilon and thickness of dielectric material, the bandwidth of instability can be increased more than twice of that for a plain conducting waveguide. GRA

N80-30737# Columbia Univ., New York. Dept. of Electrical Engineering and Computer Science.
HIGH POWER SUBMILLIMETER AND INFRARED RADIATION FROM INTENSE RELATIVISTIC ELECTRON BEAMS Final Report, 1 Jan. 1975 - 31 Dec. 1979
S. P. Schlesinger, T. C. Marshall, and P. Diament Mar. 1980 11 p refs
(Contract F44620-75-C-0055; AF Proj. 2301)
(AD-A086688; AFOSR-0545-80TR) Avail: NTIS HC A02/MF A01 CSCL 20/5

A series of experiments was performed to test the dependence of superadient power generated by stimulated Raman backscattering (at 2 mm wavelength) upon ripple-field amplitude and length. Experiments were also performed to understand the possibility of using distributed feedback in a collective mode free electron laser. A theoretical study was completed to understand the growth of circular waveguide modes by parametric coupling to cold beam waves, with field gradients included. This is similar to free electron laser configurations to be studied in upcoming experiments. GRA

N80-30738# United Technologies Research Center, East Hartford, Conn.
SHORT PULSE UV-VISIBLE WAVEGUIDE LASER Final Technical Report, 15 May 1979 - 14 May 1980
Leon A. Newman 1 Jul. 1980 72 p refs Submitted for publication
(Contract N00014-79-C-0309)
(AD-A086856; UTRC/R80-924636-1) Avail: NTIS HC A04/MF A01 CSCL 20/5

The operation of a N2(-) ion waveguide laser (4278 A) excited by charge transfer from He2(-) created in a capacitively coupled self-sustained discharge is described. In addition, the results of an experimental diagnostic program and a computer modeling program, conducted to explain the general operations of the discharge pumped He-N2 system, are presented. The results of this program indicate upper laser level electron quenching and lower level pumping may be seriously limiting the achievable laser efficiency of this system. GRA

N80-30739# Laser Analytics, Inc., Bedford, Mass.
MODEL LS-2X LASER SOURCE DETECTOR TEST SYSTEM Final Report
May 1980 27 p refs
(Contract DAAB07-78-C-2465)
(AD-A086540) Avail: NTIS HC A03/MF A01 CSCL 17/5

Proper, characterization of infrared photodiodes requires a series of optical tests that include blackbody response, spatial uniformity, pulse response, and wavelength sensitivity measurements. The results of these optical tests will depend upon many fundamental properties of the detector crystal, namely absorption depth of the radiation, bulk lifetimes of injected carriers, surface recombination effects, carrier drift and diffusion effects, trapping effects and other mechanisms. Some of these effects are not clearly understood but may play important roles in such application as high speed pulse detectors, laser heterodyne receivers, or large area high resolution detector arrays. Spears has shown that proper spatial and temporal characterization of HgCdTe CO2 laser heterodyne receivers must be done at the operating frequencies. A realistic characterization of the pulse response of an infrared detector must be made at the operating wavelength, generally that of peak detector response. Certain fixed frequency gas lasers such as CO2, CO, or HF can provide sufficient power and speed for detector characterization but they have limited wavelength coverage and are often cumbersome to use. On the other hand, Pb-salt tunable diode lasers can provide more than 100 micro w of power emitted from nearly a point source, subnanosecond risetime pulses and wavelength selectability between 2.8 and 30 micrometers. These characteristics make diode lasers an ideal source for pulse spatial response measurements of infrared detectors. GRA

N80-30740# Naval Research Lab., Washington, D. C.
SPATIAL AND TEMPORAL COHERENCE OF A 35 GHZ GYROMONOTRON USING THE TE01 CIRCULAR MODE
M. E. Read, R. M. Gilgenbach, R. Lucey, Jr., and K. R. Chu 20 Jun. 1980 22 p refs
(XF54581007)
(AD-A086997; AD-E000486; NRL-MR-4244) Avail: NTIS HC A02/MF A01 CSCL 20/5

The characteristics of a 35 GHz oscillator operating with the TE sub 01 circular waveguide mode are described. The device

produced 147 kW, with an efficiency of 31% at 100 kW. The total radiated energy was 2 KJ per pulse. The spectral coherence appears to be equal to those of other high quality microwave tubes. The mode purity is greater than 95%. GRA

N80-30741# Naval Research Lab., Washington, D. C. Optical Sciences Div.

UNSTEADY THERMAL BLOOMING OF INTENSE LASER BEAMS Final Report, 1975 - 1977

J. T. Ulrich and P. B. Ulrich 31 Jan. 1980 19 p refs
(AD-A087207; AD-E000476; NRL-8352) Avail: NTIS HC A02/MF A01 CSCL 20/5

A four dimensional (three space plus time) computer program has been written to compute the nonlinear heating of a gas by an intense laser beam. Unsteady, transient cases are capable of solution and no assumption of a steady state need be made. The transient results are shown to asymptotically approach the steady-state results calculated by the standard three dimensional thermal blooming computer codes. The report discusses the physics of the laser-absorber interaction, the numerical approximation used, and comparisons with experimental data. A flowchart is supplied in the appendix to the report. GRA

N80-30742# Stanford Univ., Calif.

LASER PHYSICS AND LASER TECHNIQUES Final Technical Report, 1 Jan. 1977 - 31 Dec. 1979

A. E. Siegman and R. L. Byer Feb. 1980 98 p refs
(Contract F49620-77-C-0092; AF Proj. 2301)
(AD-A087245; GL-3093; AFOSR-80-0551TR) Avail: NTIS HC A05/MF A01 CSCL 20/5

A three-year program research in laser physics and techniques has been carried out to help meet Air Force mid- and long-term requirements. Development of an optically pumped atomic mercury laser was completed. Picosecond spectroscopy experiment led to measurements of ultrafast relaxation and diffusion times in solids. Work on efficient numerical methods for optical resonator calculations resulted in a Fast Hankel Transform for calculations in cylindrical coordinates. Improvements to the FHT algorithm have been made and a two-stage algorithm developed. An efficient procedure for analyzing nonlinear beam interactions has been developed; also several fundamental questions on aspects of laser resonators have been resolved. A diffraction-biased ring resonator was invented, and an analysis of phase conjugate mirror resonators carried out. Studies of optically pumped lasers including mercury dimer as a potential laser mechanism were carried out. A number of two photon laser systems were investigated, and studies of four-wave mixing as a frequency conversion process completed. Improvements in the growth of lithium niobate crystals led to higher power tunable infrared and visible sources. Finally, stimulated rotational Raman scattering was demonstrated for efficient frequency conversion in the infrared. GRA

N80-30743# Maryland Univ., College Park. Dept. of Physics and Astronomy.

RESONANT INTERACTION BETWEEN AN ACTIVE MOLECULAR MEDIUM AND A FREE ELECTRON LASER

H. Wilhelmsson Dec. 1979 19 p refs
(Contract N00014-80-C-0050)
(AD-A087056; PUB-80-116; TR-80-068) Avail: NTIS HC A02/MF A01 CSCL 20/5

The system of a relativistic electron beam and an active molecular (maser) medium in the presence of a ripple magnetic field is studied theoretically. The tunability of the free electron laser could be used to reach different lines of such a molecular medium. We use a Lorentz model to describe the molecular transitions, a hydromagnetic model for the beam, and formulate the resonance condition for the two cases where (1) the coupling occurs at a common interface, e.g., cylindrical, between the beam and the molecular medium, and (2) the beam and the molecules fill the same volume in space. The coupling between the beam and the molecules offers possibilities of enhanced radiation and improved coherence. In the case where the free electron laser acts as a pump of the molecules stimulated radiation could in principle be obtained at a new wavelength, i.e., the coupled system acts as a frequency transformer. GRA

N80-30744# Army Missile Command, Redstone Arsenal, Ala. High Energy Laser Center.

MID-TERM PROGRESS REPORT ON THE DEVELOPMENT OF ARMY CLOSED CYCLE CIRCULATOR (CCC) SYSTEM

Myron W. Cole and Cornelius C. Shih 20 Sep. 1979 110 p refs
(AD-A087219; AD-E950001; DRCPM-HEL-79-5) Avail: NTIS HC A06/MF A01 CSCL 14/2

A closed cycle circulator system was developed for recirculating the laser gas through the cavity in order that problems of acoustic attenuation, thermal control, gas contamination, and power gain may be investigated for various pulsed energy inputs at the cavity. The circulator was assembled and tested for its performance evaluation. Its instrumentation subsystem was developed and calibrated to a reasonable accuracy. For safety, standard operating procedures have been established for review and approval. The instruments calibrated include hot wire anemometers for velocity and temperature, piezoelectric transducers for pressure, flowmeter for mass flow rate, and interferometer for medium homogeneity. A series of trial tests of the closed cycle circulator system resulted in an experimental analysis of performance data providing a better control of flow conditions in the cavity through the control mechanism. GRA

N80-30745# Oak Ridge National Lab., Tenn.

EVALUATION OF A HIGH POWER SUBMILLIMETER PULSED LASER SYSTEM

K. L. VanderSluis, D. P. Hutchinson, and P. A. Staats 1980 7 p Presented at the Japan/US Workshop on Far-Infrared Diagnostics, Boston, 28 Jan. 1980
(Contract W-7405-eng-26)
(CONF-800138-1) Avail: NTIS HC A02/MF A01

The selection, development, and testing of the system components are described. The power and frequency profiles achieved in tests made on the assembled system are included. These results, and knowledge gained through design and development work, have suggested improvements in design characteristics to be applied to future research on this diagnostic method. DOE

N80-30746# Thomson-CSF, Orsay (France). Lab. Central de Recherches.

SEMICONDUCTOR LASER TECHNOLOGY: STRIPE STRUCTURE Final Report [TECHNOLOGIE LASER SEMICONDUCTEUR, STRUCTURE RUBAN]

J. C. Carballes, E. Duda, and J. Apruzzese Jan. 1978 48 p refs In FRENCH; ENGLISH summary
(Contract DGRST-76-7-0686)
(LCR-34-078/R/G5) Avail: NTIS HC A03/MF A01

Different types of stripe geometry lasers were analyzed and fabricated by the following methods: shallow proton implantation (no proton penetration in the active layer); deep proton implantation (proton penetration in the active layer); mesa etching (stripe obtained by chemical etching); and oxide isolation (local oxidation on the P side layer). The P.I characteristic (light power versus current intensity), near and far field diagram, astigmatism and thermal resistance of lasers were studied. The properties of the different types of lasers was made were examined, and their potential applications were determined. It is shown that shallow proton implantation is feasible for optical communication applications. Oxide isolation is relevant to fabrication of high light power emitting lasers. Author (ESA)

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N80-30747 Toledo Univ., Ohio.

SENSOR FAILURE ANALYSIS AND MULTIVARIABLE CONTROL FOR AIRBREATHING PROPULSION SYSTEMS Ph.D. Thesis

Khosrow Behbehani 1979 244 p
Avail: Univ. Microfilm Order No. 8019360

A sensor/actuator failure analysis technique for turbofan jet engines is developed. The technique utilizes redundant information

embedded in the engine model residual and does not require multiple hardware redundancy. Three phases of failure analysis, namely detection, isolation, and accommodation are considered. Failure detection and isolation techniques are developed by utilizing the concept of generalized likelihood ratio (GLR) tests. These techniques are applicable to both time-varying and time-invariant systems. Three GLR detectors are developed for: (1) hard-over sensor failure; (2) hard-over actuator failure; (3) brief disturbances in the actuators. The probability distribution of the GLR detector and the detectability of sensor/actuator failures are established. Failure type is determined by the maximum of the GRL detectors. Failure accommodation is accomplished by extending the multivariable nyquest array control design techniques to nonsquare system design. Dissert. Abstr.

N80-30748 Lehigh Univ., Bethlehem, Pa.
THE EFFECTS OF TITANIUM ON SUBMERGED-ARC WELD METAL Ph.D. Thesis
James P. Snyder, III 1980 108 p
Avail: Univ. Microfilms Order No. 8019728

The effects of titanium on the mechanical properties and microstructure in the submerged arc weld deposit of high strength, low alloy, silicon aluminum killed, low sulfur steels containing various amounts of titanium were determined. The titanium was introduced into the weld via dilution from the base plate. The nominal carbon, manganese, silicon, and titanium ranges in the weld deposits were 0.05 to 0.15, 1.0 to 1.4, 0.35 to 0.60, and 0.0 to 0.15% respectively. Generally, yield and tensile strengths correlated well with carbon, manganese, silicon, and titanium. Yield strength ranged from 449 to 535 MPa and tensile strengths ranged from 570 to 648 MPa. As titanium increased, both the yield and tensile strengths increased. The toughness was strongly dependent on titanium and manganese content, while carbon and silicon had smaller effects. Toughness ranged from 5J at -46 C to 106J at +52 C. Titanium reduced toughness by increasing the maximum weld hardness through solid solution hardening and also by increasing the amount of ferrite veining at low manganese levels. Manganese improved toughness by reducing the amount of ferrite veining and by refining the microstructure. Although titanium is detrimental to the toughness of submerged arc welds, its deleterious effects can be offset by proper selection of welding consumables. Dissert. Abstr.

N80-30749*# Rensselaer Polytechnic Inst., Troy, N. Y. School of Engineering.
AN ADVANCED TERRAIN MODELER FOR AN AUTONOMOUS PLANETARY ROVER
Erwin L. Hunter Jul. 1980 91 p refs Prepared for JPL
(Grant NsG-7369; Contract JPL-954880)
(NASA-CR-163485; RPI-TR-MP-67) Avail: NTIS HC A05/MF A01 CSCL 13I

A roving vehicle capable of autonomously exploring the surface of an alien world is under development and an advanced terrain modeler to characterize the possible paths of the rover as hazardous or safe is presented. This advanced terrain modeler has several improvements over the Troiani modeler that include: a crosspath analysis, better determination of hazards on slopes, and methods for dealing with missing returns at the extremities of the sensor field. The results from a package of programs to simulate the roving vehicle are then examined and compared to results from the Troiani modeler. L.F.M.

N80-30750*# Rensselaer Polytechnic Inst., Troy, N. Y. School of Engineering.
A PROPULSION SYSTEM FOR THE MARS ROVER VEHICLE
David C. Bogdan Aug. 1980 60 p refs Prepared for JPL
(Grant NsG-7369; Contract JPL-954880)
(NASA-CR-163494; RPI-TR-MP-70) Avail: NTIS HC A04/MF A01 CSCL 13I

The vehicle control electronics for the Mars rover vehicle is described. A functional description of the electronics and its place in the entire system is given. The hardware involved is described from a user's point of view. Changes and additions to the software are included. T.M.

N80-30751*# Rensselaer Polytechnic Inst., Troy, N. Y. School of Engineering.
A PROPULSION AND STEERING CONTROL SYSTEM FOR THE MARS ROVER
Jeffrey M. Turner Aug. 1980 82 p refs
(Grant NsG-7369; Contract JPL-954880)
(NASA-CR-163501; RPI-TR-MP-77) Avail: NTIS HC A05/MF A01 CSCL 13I

The design of a propulsion and steering control system for the Rensselaer Polytechnic Institute prototype autonomous Mars roving vehicle is presented. The vehicle is propelled and steered by four independent electric motors. The control system must regulate the speeds of the motors so they work in unison during turns and on irregular terrain. An analysis of the motor coordination problem on irregular terrain, where each motor must supply a different torque at a different speed is presented. A procedure was developed to match the output of each motor to the varying load. A design for the control system is given. The controller uses a microprocessor which interprets speed and steering commands from an off-board computer, and produces the appropriate drive voltages for the motors. T.M.

N80-30752# Army Armament Research and Development Command, Dover, N. J. Scientific and Engineering Applications Div.
THE SHAFT BOOK: DESIGN CHARTS FOR TORSIONAL PROPERTIES OF NONCIRCULAR SHAFTS: USER'S MANUAL
Robert I. Isakower Mar. 1980 95 p refs
(AD-A086498; MISD-UM-80-5) Avail: NTIS HC A05/MF A01 CSCL 20/11

Design charts and tables have been developed for the elastic torsional stress analyses of free prismatic shafts, splines and spring bars with virtually all commonly encountered cross sections. Circular shafts with rectangular and circular keyways, external splines, and milled flats along with rectangular and X-shaped torsion bars are presented. A computer program was developed at the U.S. Army ARRADCOM, Dover, N.J. site which provides a finite difference solution to the governing (POISSON's) partial differential equation which defines the stress functions for solid and hollow shafts with generalized contours. Using the stress function solution for the various shapes and Prandtl's membrane analogy, the author is able to produce dimensionless design charts (and tables) for transmitted torque and maximum shearing stress. The design data have been normalized for a unit dimension of the cross section (radius or length) and are provided in this report for solid shapes. The eleven solid shapes presented, along with the classical circular cross section solution, provides the means for analyzing 144 combinations of hollow shafts with various outer and inner contours. Hollow shafts may be analyzed by using the computer program directly or by using the solid shape charts in this report and the principles of superposition based on the concept of parallel shafts. GRA

N80-30753# General Electric Co., Schenectady, N. Y. Gas Turbine Div.
DEVELOPMENT OF HIGH-TEMPERATURE TURBINE SUBSYSTEM TECHNOLOGY TO A TECHNOLOGY READINESS STATUS, PHASE 2 Quarterly Report, Jan. - Mar. 1980
M. W. Horner May 1980 77 p refs
(Contract EX-76-C-01-1806)
(FE-1806-86) Avail: NTIS HC A05/MF A01

Progress in the development of a coal derived low BTU gas fueled high temperature, 2600 to 3000 F firing temperature, gas turbine for use in a combined cycle power plant is reported. Information is included on component design and testing, materials testing, and evaluation of the commerical viability of the gas turbine system. DOE

N80-30754# General Electric Co., Schenectady, N. Y. Gas Turbine Div.
DEVELOPMENT OF HIGH TEMPERATURE TURBINE SUBSYSTEM TECHNOLOGY TO A TECHNOLOGY READINESS STATUS, PHASE 2 Progress Report, Dec. 1979
10 Jan. 1980 37 p
(Contract EX-76-C-01-1806)
(FE-1806-79) Avail: NTIS HC A03/MF A01

Fabrication of the hot gas path development test stand is completed and the mixing chamber and the three combustion

chambers were delivered. Successful casting for the second stage nozzle was made. Ultrasonic nondestructive evaluation of the composite water-cooled nozzle was completed. No unbonding of the composite materials was detected. A plan for sectioning the nozzle for further evaluation is being prepared. Heat transfer testing on the flat plate specimen in the shock tunnel is continuing. Testing of radial cooling passages in the motorized rig continues. The effects of channel tilt, rotational speed, and channel diameter on the heat transfer performance of the passage were evaluated. Results continue to validate the design adequacy of this bucket cooling approach. Fired stability testing of the combustor fuel nozzle on test fuel (propane/steam) in the atmospheric test stand was completed. All configurations tested demonstrated adequate flame stability. Detailed status of the combustor development is reported. DOE

N80-30755# General Electric Co., Philadelphia, Pa. Valley Forge Space Center.

DESIGN AND DEVELOPMENT OF STIRLING ENGINES FOR STATIONARY POWER APPLICATIONS IN THE 500 TO 3000 HP RANGE. SUBTASK 1A REPORT: STATE-OF-THE-ART CONCEPTUAL DESIGN

1 Mar. 1980 363 p

(Contract DE-AC02-79ET-15209)

(DOE/ET-15209-T1) Avail: NTIS HC A16/MF A01

Reliable cost data for a stationary Stirling engine capable of meeting future needs for total energy/cogeneration systems were obtained and a pragmatic and conservative base design for a first generation hardware was established. Four engine types, V-type crank engine, radial engine, swashplate engine, and rhombic drive engine, and three heat transport systems, heat pipe, pressurized gas heat transport loop, and direct gas fired system, were selected. After a preliminary layout cycle, the rhombic drive engine was eliminated due to intolerable maintenance difficulties on the push rod seals. The V, radial and swashplate engines were taken through a detailed design/layout cycle, to establish all important design features and reliable engine weights. After comparing engine layouts and analyzing qualitative and quantitative evaluation criteria, the V-crank engine was chosen as the candidate for a 1985 hardware demonstration. DOE

N80-30756# Miami Univ., Coral Gables, Fla.

HYDROGEN ENGINE PERFORMANCE ANALYSIS PROJECT Annual Report

Robert R. Adt, Jr., Michael R. Swain, and John M. Pappas Jan. 1980 469 p refs Prepared in cooperation with Hawthorne Research and Testing, Inc., Coral Gables, Fla.

(Contract EC-77-C-03-1212)

(SAN-1212-T1; AR-2) Avail: NTIS HC A20/MF A01

Baseline data for throttled and unthrottled, carburetted and timed hydrogen induction, IVC hydrogen-fueled engine configurations, with and without exhaust gas recirculation and water injection, were obtained. These data, along with descriptions of the test engine and its components, the test apparatus, experimental techniques, experiments performed and the results obtained, are given. Analyses of other hydrogen-engine project data are also presented and compared with the results of the present effort. The unthrottled engine vis-a-vis the throttled engine is found, in general, to exhibit higher brake thermal efficiency. The unthrottled engine also yields lower No sub x emissions, which were found to be a strong function of fuel-air equivalence ratio. DOE

N80-30757# Biphase Energy Systems, Inc., Santa Monica, Calif.

DESIGN STUDY OF A TWO-PHASE TURBINE BOTTOMING CYCLE Final Report

Walter R. Studhalter 15 Jun. 1979 123 p refs

(Contract EY-76-C-03-1207)

(DOE/ET-15350-T1) Avail: NTIS HC A06/MF A01

The use of a biphase turbine system to recover waste heat from diesel engines was examined and found to have many favorable attributes. Among these were low rpm, high torque, low heat exchanger cost, and simplicity. Several candidate working fluid combinations were tested at temperatures of interest. The contact heat exchanger concept was substantiated by large scale experiment. The program includes subscale tests of key hardware components of a biphase turbine bottoming system. These are the two-phase nozzle, two-phase turbine, and direct contact heat exchanger. A comprehensive cost analysis was completed. A three-year program leading to a full-size system field demonstration is planned. Progress in the first year of this program and the effort started on the second year program are reported. DOE

N80-30758# Virginia Polytechnic Inst. and State Univ., Blacksburg. Coll. of Engineering.

PERFORMANCE OF A DIESEL ENGINE OPERATING ON RAW COAL-DIESEL FUEL AND SOLVENT REFINED COAL-DIESEL FUEL SLURRIES Final Report

H. P. Marshall Mar. 1980 129 p refs

(Contract ET-78-S-01-3288)

(CONS-3288-T6) Avail: NTIS HC A07/MF A01

Performance tests using an 11 kW single cylinder diesel engine were made to determine the effects of three different micronized coal fuel oil slurries being considered as alternative fuels. Slurries containing 20, 32, and 40% wt micronized raw coal in no. 2 fuel oil were used. Results are presented indicating the changes in the concentrations of SO sub X and NO sub X in the exhaust, exhaust opacity, power and efficiency, and in wear rates relative to operation on fuel oil no. 2. The engine was operated for 10 hours at full load and 1400 rpm on all fuels except the 40% wt slurry. This test was discontinued because of extremely poor performance. DOE

N80-30759# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).

ASSEMBLY AND TESTING OF A CATALYTIC HYDRAZINE GAS GENERATOR Final Report

E. O. Breves 22 Feb. 1980 194 p

(Contract ESTEC-3450/77-NL-AK(SC))

(VB-0421-011-B; ESA-CR(P)-1322) Avail: NTIS HC A09/MF A01

A standard OTS 2N catalytic hydrazine thruster was modified for use as a gas generator and life tested in a gas generator plenum system for a period of 1 year. The plenum system comprised a 7 liter tank, feeding two 0.1 N thrusters via a 5 micron filter. The thrusters were operated in a pulsed mode at a duty cycle of 0.1 s ON/1 s OFF. The plenum tank pressure was maintained between 1.9 and 2.1 bar by automatic cycling of the gas generator. The operating frequency of the gas generator was typically every 45 minutes. The operating duration per cycle was a function of the hydrazine inlet pressure. The pre-heat holding temperature of the gas generator was 180/C. The gas generator performed flawlessly during the test. However, X-ray examination of the catalyst bed at the end of test revealed that about 25% of the catalyst had been lost and that the second catalyst retainer screen had incurred a weld failure, becoming detached and displaced on one side of the chamber wall. This mechanical degradation had no influence on the performance of the gas generator. During the tests problems were encountered involving metallic cyanide deposits which blocked the thruster values. Author (ESA)

N80-30760# European Space Agency, Paris (France).

INVESTIGATION OF THE SOLIDIFICATION BEHAVIOR OF ELECTRON BEAM WELDS UNDER MICROGRAVITATIONAL CONDITIONS

Hartmut Bogs, Peter R. Sahm, and Peter Hesse Jan. 1980 90 p refs Transl. into ENGLISH of "Untersuchung der Erstarrungsbedingungen von Elektronenstrahlschweissen unter Abzug der Gravitationsbedingten Konvektion in der Schmelze", Rept. BMFT-FB-W-77-40 Brown, Boverie und Cie A.G., Heidelberg Dec. 1977 Original report in GERMAN previously announced as N79-30372

(ESA-TT-591; BMFT-FB-W-77-40) Avail: NTIS HC A05/MF A01; ZLDI, Munich DM 21,40

A literature survey was conducted to find ways and formulate how to visualize convection currents in the EB-melt-channel and thereby localize the g-dependent components of this convection. Preliminary experiments were conducted with steels to find ways to show how convection influences microstructure and properties. The results of this work have been summarized in three proposals for further experimentation. These are: electron beam welding of a transparent medium to directly visualize convection phenomena; utilization of larger than lg-values in order to extrapolate back to Og-behavior; and controlled experiments with Cr-steels

to measure the effect of convection on mechanical properties and microstructure. Author (ESA)

N80-30761# National Centre of Tribology, Risley (England). European Space Tribology Lab.

VACUUM TESTS ON A ROTARY/LINEAR SLEEVE BEARING

J. Gillies and R. B. Watters Sep. 1979 18 p

(Contract ESA-2584/79)

(ESA-ESTL-42; ESA-CR(P)-1326) Avail: NTIS HC A02/MF A01

A proprietary 1 inch nominal I/D ROTCLIN linear sleeve bush bearing was tested and compared with angular contact bearings of similar size. The bearing was torque tested in air and in vacuum over small forward and reverse angular and axial movements of the bearing shaft, and under varying conditions of temperature. Thermal conductance of the bearing stiffness was calculated and compared with a similar diameter deep groove or angular contact bearing. Author (ESA)

N80-30762# University Coll. of Swansea (Wales). Swansea Tribology Centre.

MOLYBDENUM DISULPHIDE LUBRICATION. A CONTINUATION SURVEY: 1979 TO 1980

A. R. Lansdown 1979 82 p refs

(Contract ESTEC-2261/74)

(STC-79/419; ESA-CR(P)-1330) Avail: NTIS HC A05/MF A01

The history of MoS2 as a lubricant is addressed. Specification emphasis is placed on its chemical and physical properties, the mechanism of lubrication, bonded films, lubrication by MoS2 alone or in bulk solids, oils and greases. Other dichalcogenides are mentioned as are design guidance, performance prediction, corrosion, quality control and testing. Author (ESA)

N80-30763# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.

ADVANCED COMBUSTION SYSTEMS FOR STATIONARY GAS TURBINE ENGINES. VOLUME 3: COMBUSTOR VERIFICATION TESTING Final Report, Jan. 1978 - Apr. 1979

R. M. Pierce, C. E. Smith, and B. S. Hinton Jan. 1980 153 p refs

(Contract EPA-68-02-2136)

(PB80-177108; FR-11405; EPA-600/7-80-017C) Avail: NTIS HC A08/MF A01 CSCL 13B

The scaleup of the rich-burn/quick-quench (RB/QQ) model to a full scale gas turbine combustor is described and test results from the full scale evaluations are documented. Test results were very positive, showing that the RB/QQ concept can reduce NOx to approximately 45 ppm for clean distillate oil and to approximately 75 ppm for a distillate oil doped to 0.5% nitrogen, as pyridine. Carbon monoxide emissions below the 100 ppm program goal were also demonstrated. These tests also indicate that this combustor concept may be capable of low emission performance on petroleum residual oil and synthetic liquid fuels such as SRC 11 or shale oil. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N80-30764 Iowa State Univ. of Science and Technology, Ames.

SOME TOPICS IN RELIABILITY THEORY Ph.D. Thesis

Nader Baradaran Ebrahimi 1980 122 p

Avail: Univ. Microfilms Order No. 8019629

Various notions of multivariate negative dependence are introduced and their interrelationship is studied. Examples are given to illustrate these concepts. Applications of the results in statistics and probability are given. A partial ordering is developed among negative quadrant dependent distributions with fixed marginals. Basic properties and closure under certain statistical operations are derived. Applications of the results in statistics and probability are given. Various definitions of multivariate new better than used (NBU) and new better than used in expectation (NBUE) life distributions are introduced and their interrelationship is studied. Examples are given to illustrate these concepts. Various closure properties of multivariate NBU and NBUE distributions are proved. It is shown how shock models governed by a general counting process satisfying certain conditions can generate multivariate NBU and NBUE distributions. Dissert. Abstr.

N80-30765# Florida State Univ., Tallahassee. Dept. of Statistics.

IMPERFECT REPAIR Interim Report

Mark Brown and Frank Proschan Apr. 1980 16 p refs

(Contract F49620-79-C-0157; Grant AF-AFOSR-3678-78; AF Proj. 2304)

(AD-A086845; FSU-Statistics-M546; AFOSR-78-108TR; AFOSR-80-0533TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

A device is repaired at failure. With probability p, it is returned to the 'good as new' state (perfect repair); with probability 1 - p it is returned to the functioning state, not is only as good as a device of age equal to its age at failure (imperfect repair). Repair takes negligible time. We obtain the distribution F sub p of the interval between successive good as new states in terms of the underlying life distribution F. We show that if F is in any of the life distribution classes: IFR, DFR, IFRA, DFRA, NBU, NWU, DMRL, or IMRL, then F sub p is in the same class. Finally, a number of monotonicity properties for various parameters and random variables of the stochastic process is obtained. The results obtained are of interest in the context of stochastic processes in general, as well as being useful in the particular imperfect repair model studied. GRA

N80-30766# IBM Federal Systems Div., Gaithersburg, Md.

ANALYSIS OF DISCRETE SOFTWARE RELIABILITY MODELS Final Technical Report, Oct. 1978 - Sep. 1979

W. D. Brooks and R. W. Motley Griffiss AFB, N.Y. RADC Apr. 1980 144 p refs

(Contract F30602-78-C-0346; AF Proj. 5581)

(AD-A086334; RADC-TR-80-84) Avail: NTIS HC A07/MF A01 CSCL 09/2

Discrete (binomial and Poisson) software reliability models, previously developed by IBM, are presented. They were examinnd for their validity using historical data provided by RADC from seven development projects. Simulated error data that closely agreed with the model assumptions were also used for validation. The results indicated that the models provide reasonable fits to the historical error data. GRA

N80-30767# Aerospace Corp., El Segundo, Calif. Guidance and Control Div.

ORIENTATION OF MEASUREMENT SENSORS FOR OPTIMUM END-OF-LIFE PERFORMANCE Final Report

P. K. Mazaika 25 Jun. 1980 28 p refs

(Contract F04701-79-C-0080)

(AD-A086280; TR-0080-5901-03-1; SD-TR-80-41) Avail: NTIS HC A03/MF A01 CSCL 14/4

Relative orientations of on-board measurement sensors are found that ensure the best possible measurement accuracy in the end-of-life situation when all but three sensors have failed. For five and six sensors, the optimum orientations are, respectively, the single cone and dodecahedron configurations. For seven and eight sensors, new configurations are found that are, respectively, 25 and 20% more accurate than previously proposed configurations. In general, there is a tradeoff between performance at end-of-life and performance earlier in a configuration's lifetime. GRA

N80-30768# Martin Marietta Aerospace, Orlando, Fla. Microelectronics Lab.

COMPUTER AIDED AUTOMATED HYBRID SUBSTRATE PROBE TESTING DEVELOPMENT Final Report, Oct. 1978 - Mar. 1980

Connie D. Gill and Robert E. Sulouff (Microelectronics Engineering Corp., Auburn, Ala.) 31 Mar. 1980 39 p refs

(Contract DAAK40-78-C-0299)

(AD-A087124; OR-15908) Avail: NTIS HC A03/MF A01 CSCL 14/2

The use of an electron beam for the contactless probing of hybrid substrates is discussed. The injection of an electrical charge using the electron beam results in a surface field which enhances the generation of secondary electrons which a second electron probe is directed at a substrate probe position. The discussion of the theoretical basis and experimental findings are correlated. The results of this study indicate that a new method of substrate probing exists. However, careful interpretation of the results must be performed. The applicability to multilayer thick film substrates suggest future adaptation as an in-line manufacturing or test technique. GRA

N80-30769# Grumman Aircraft Engineering Corp., Bethpage, N. Y.
DESIGN GUIDELINES AND OPTIMIZATION PROCEDURES FOR TEST SUBSYSTEM DESIGN Final Report, May 1978 - May 1979
Donald N. Lord, George A. Walz, and Stan Green Apr. 1980 267 p refs
(Contract F30602-78-C-0167; AF Proj. 2338)
(AD-A087059; RADC-TR-80-111) Avail: NTIS HC A12/MF A01 CSCL 14/2

This study provides guidelines and procedures to optimize the design of built-in-test equipment. The procedures are applicable to the design of both avionic and ground electronic systems. Optimization of the test subsystem is achieved by properly specifying three key design parameters (test effectiveness, mean corrective maintenance time, and test subsystem production costs) during the Conceptual Phase. These parameters then form the 'design to' criteria for optimization during the System, Subsystem, and Detail Design Phases. The report provides straightforward mathematical tools, algorithms, and trade-off procedures to assist the designer during each design phase. GRA

N80-30770# Societe Anonyme Belge de Constructions Aeronautiques, Brussels (Belgium).
HIGH PERFORMANCE VCHP LIFE TEST Final Report
Dec. 1979 60 p refs
(Contract ESA-3007/76)
(ESA-CR(P)-1321) Avail: NTIS HC A04/MF A01

A one year aging test was conducted on stainless steel, ammonia filled, 9.5 mm diameter variable conductance heat pipes (VCHP). The VCHP's are capable of transporting 100 watt meter and of achieving a temperature control range of 8 C when operated passively. One year aging was completed without degradation of the maximum heat transport or temperature control range. Several parameters influencing the temperature control range were further investigated. Aging will continue for two more years under the same conditions. Author (ESA)

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis: fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N80-30771 Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 12, NO. 5
Judith Nagle-Eshleman, ed. May 1980 115 p refs
(AD-A085328) Avail: Naval Research Lab., Attn. code 5804, Washington, D.C. 20375. Annual rate HC $100.00 CSCL 20/11

Dynamic problems related to shock and vibration are addressed. Specific emphasis is given to the technical developments applicable to problems on the following systems: sea systems; ground system; air system; and space systems. For individual titles, see N80-30772 through N80-30773.

N80-30772 Army Materials and Mechanics Research Center, Watertown, Mass.
SHOCK IN SOLIDS: ARMY MATERIALS RESEARCH AND APPLICATIONS
R. Shea and J. F. Mescall *In* Shock and Vibration Information Center. *The Shock and Vibration Digest, Vol. 12, No. 5* May 1980 p 7-18 refs Presented at the 50th Shock and Vibration Symp., Colorado Springs, Colo., Oct. 1979 (For primary document see N80-30771 21-39)
Avail: Naval Research Lab., Attn. code 5804, Washington, D.C. 20375. Annual rate HC $100.00 CSCL 20/11

Guidelines are presented for using existing materials and to develop materials for armor, penetrators, and fragment devices. The codes for predicting the shock response of solids are discussed as well as failure mechanisms and current research efforts. R.C.T.

N80-30773 Argonne National Lab., Ill.
CROSS-FLOW-INDUCED INSTABILITIES OF CIRCULAR *CYLINDERS*
S. S. Chen *In* Shock and Vibration Information Center. The Shock and Vibration Digest, Vol. 12, No. 5 May 1980 p 21-34 refs (For primary document see N80-30771 21-39)
Avail: Naval Research Lab., Attn. code 5804, Washington, D.C. 20375. Annual rate HC $100.00 CSCL 20/11

Dynamic instability of circular cylinder arrays subjected to cross flow is reviewed. Instability mechanisms, different types of instability, mathematical models, empirical correlations for the critical flow velocity, and effects of various system parameters are discussed. Author

N80-30774 California Inst. of Tech., Pasadena.
THE APPLICATION OF OPTICAL INTERFEROMETRY TO *TIME DEPENDENT UNBONDING*, PARTS 1, 2, AND 3 Ph.D. Thesis
Kenneth MacDougall Liechti 1980 155 p
Avail: Univ. Microfilms Order No. 8020424

The local crack front deformation is measured to examine the limits of the validity for the linear theory and to provide a basis for future modelling. Within this framework, particular attention is paid to the aspects of local failure mode interaction and the time dependence of the unbonding process. The small displacements in the crack front region require a resolution on the order of a wavelength of light. The experimental techniques used are therefore based on optical interferometry. The displacements applied to the adherends are controlled to the same order by a thermally actuated servoloading device. The development of the experimental techniques used to measure the unbound profiles as well as to measure and control the displacements applied to the adherends are discussed. For stationary cracks, experiments are described which examine the extent of the nonlinearity in the crack front deformation field while fracture criteria are developed and compared for unbonding rates in steadily propagating cracks. Proposals for improvement of the experimental techniques and further experiments are discussed. Dissert. Abstr.

N80-30775 Carnegie-Mellon Univ., Pittsburgh, Pa.
ON THE DYNAMIC ENERGY RELEASE RATE IN ELASTIC CRACK PROPAGATION Ph.D. Thesis
Chikayoshi Yatomi 1980 52 p
Avail: Univ. Microfilms Order No. 8020172

A unified treatment of the dynamic energy release rate, epsilon, for a sharp, straight crack in a hyperelastic body undergoing finite strain is presented. Epsilon is decomposed into the usual quasi static energy release rate plus a nonpositive dynamic contribution. Thus, for a dynamic solution the energy release rate computed using the classical quasi static formula is larger than the actual dynamic energy release rate. Dissert. Abstr.

N80-30776 Rensselaer Polytechnic Inst., Troy, N. Y.
ON THE THERMOMECHANICAL RESPONSE OF 3.5 Ni-Mo-V* ALLOY STEEL AND TYPE 304 STAINLESS STEEL UNDERGOING CYCLIC UNIAXIAL INELASTIC DEFORMATION *Ph.D. Thesis
Steven Lester Adams 1980 208 p
Avail: Univ. Microfilms Order No. 8020394

The rise in temperature technique was used to measure the thermomechanical responses of 3.5 Ni-Mo-V low alloy steel and type 304 stainless steel subjected to fully reversed strain controlled cyclic uniaxial deformation. The nominal total mechanical strain

range was equal to 0.01 and the test frequency was 1.0 hz. Both materials exhibited significant self-heating with maximum specimen temperatures increasing 55 C after one hundred seconds. A comparison of measured temperatures with predicted temperatures which had been calculated assuming the complete convertibility of the mechanical plastic work into heat shows that it is necessary to postulate a structural power response in order to completely match the measured temperature response. The structural power response exhibited a transient and a quasi steady-state component. Both the 3.5 Ni-Mo-V and the type 304 stainless possessed cumulative energy stored or released responses similiar to torsionally deformed OFHC copper.

Dissert. Abstr.

NBD-30777 Rensselaer Polytechnic Inst., Troy, N. Y.
LINEAR-NONLINEAR INTERFACE FOR FINITE ELEMENT TRANSIENT IMPACT DAMAGE ANALYSIS Ph.D. Thesis
Kenneth William Brown 1980 105 p
Avail: Univ. Microfilms Order No. 8020397

A nonlinear transient finite element structural model is interfaced with a linear finite element representation. This analysis technique, which allows local nonlinear modeling of a predominantly linear structural response, is shown to be particularly applicable to impact damage analysis of jet engine fan blades, due to the relatively local nature of blade nonlinear response to impact events, coupled with the large area where linear theory is sufficient for blade impact response definition. Analysis efficiency is enhanced through elimination of stiffness recomputation over the regions of the structure where linear theory is appropriate. Additional enhancement is obtained through the application of problem size reduction procedures to the linear analysis region. Using the present techniques run time reductions of greater than seventy per cent were attained. Comparisons are made between test and the present analysis technique for three test cases. Very good correlations are noted between test and analysis for deflections of a.. explosively loaded flat plate and a gelatin ball impacted flat panel. Dynamic strain comparisons are shown, with good agreement between test and analysis. Dissert. Abstr.

NBD-30778 Washington Univ., Seattle.
TECHNIQUES OF ANALYSIS OF LOAD-DISPLACEMENT RECORDS BY J-INTEGRAL METHODS Ph.D. Thesis
Hugo Alejandro Ernst 1979 215 p
Avail: Univ. Microfilms Order No. 8019161

Exact methods are used to obtain J from a single load displacement record for different configurations based on dimensional analysis and deformation theory of plasticity to imply the dependence of the load on crack length and displacement. The methods also permit the evaluation of the crack length increment delta a and hence complete J-R curves can be constructed. Formulae for T sub mat and T sub app are presented as well. Conditions for the existence of the so called eta factor are stated, and subsequent simplifications of the general method by its use are shown. Results of analysis of experimental work for different configuration material combinations are presented showing the adequacy of the general methodology.

Dissert. Abstr.

NBD-30779 California Inst. of Tech., Pasadena.
ON THE PROPAGATING BUCKLE AND ITS ARREST Ph.D. Thesis
Stelios Kyriakides 1980 198 p
Avail: Univ. Microfilms Order No. 8019894

If an offshore pipeline locally buckles in the presence of sufficiently large external pressure, a propagating buckle is initiated. The buckle propagates along the pipeline until it encounters a region of adverse conditions-low pressure or an arresting device. The lowest pressure at which a buckle propagates is defined as the propagation pressure. An experimental study of this quantity is presented and a semi-empirical expression derived by examining various models of the phenomenon. The dynamics of the propagating buckle are also examined and a parametric study of the steady state velocity of propagation is carried out. A systematic way of empirically deriving the parametric dependence of arresting devices is included and experimental results of two such arrestors are discussed. A 'flip-flop' mode of propagation was discovered and studied. An explanation of the phenomenon is attempted. Dissert. Abstr.

NBD-30780 South Carolina Univ., Columbia.
GENERAL SHEARING SPECKLE INTERFEROMETRY AND NUMERICAL BOUNDARY-INTEGRAL TECHNIQUES IN EXPERIMENTAL MECHANICS Ph.D. Thesis
Faissal Abdel Haleem Moslehy 1980 102 p
Avail: Univ. Microfilms Order No. 8020306

Laser speckle interferometry is used as an experimental technique to measure in-plane surface displacement components of a deformed solid. A general theory of laser speckle interferometry which includes both the contributions of in-plane and out of plane deformation is developed and verified through several experimental examples. The basic information consists of a double exposure photographic record of a sheared wavefront of the image of the surface points of a body in a reference and deformed configurations. Several examples are presented to illustrate the application of the coupled laser speckle interferometry and boundary integral solution technique to two dimensional elasticity problems. This coupled technique between laser speckle interferometry and the numerical boundary integral equation method proved to be an accurate and efficient procedure for solving significant engineering problems. Dissert. Abstr.

NBD-30781 Michigan State Univ., East Lansing.
LARGE DEFLECTION RESPONSE OF AN ELLIPTICAL SECTION RING TO DISTURBED AXIAL LOAD Ph.D. Thesis
Lawrence Alan Nattrass 1980 155 p
Avail: Univ. Microfilms Order No. 8020725

The behavior of a circular ring with an elliptical cross-section was studied to determine its suitability as a spring. The design parameters for a spring system to support and axial load included an annular configuration of fixed diameter and minimum volume. The load and deflection range were specified. Since the spring supported a mass, the natural frequency of the system was also a consideration. Considering the need to store a fixed amount of energy in a minimum volume, the optimum spring appeared to be one which had a flat load-deflection curve. The load-deflection characteristics of the ring proved to meet most of the system parameters. The uniqueness and originality of the concept necessitated the development of an analytical model, prediction of performance and failure parameters and experimental verification of the design. An analytical model was developed to predict the force-deflection and stress-deflection characteristics of a given ring. The effects of friction were considered and the useful range of the ring was described in terms of critical angles for self-locking. The model agreed with the experimental results.

Dissert. Abstr.

NBD-30782 Massachusetts Univ., Amherst.
NONLINEAR BEHAVIOR OF GUYED TOWERS Ph.D. Thesis
Chi-Yuan Ling 1980 160 p
Avail: Univ. Microfilms Order No. 8019476

The large deflection, elastic behavior of guyed towers subjected to both vertical and horizontal loads at the top is investigated. The exact governing nonlinear equations are derived using variational calculus and solved by means of the Newton-Raphson method. Postbuckling paths for systems with or without pretension in the cables are obtained. The collapse loads of systems with vertical loads as well as vertical and horizontal loads are determined. The effect of a distributed wind load on the tower is also studied. Both cables with and without the effect of sag due to wind and weight are considered. Numerical results are presented. Only relatively short towers, approximately 100 ft. tall, that are supported by a single set of guy wires are discussed. Both three and four cable guys as well as fixed and hinged mast bases are considered. Dissert. Abstr.

NBD-30783 Minnesota Univ., Minneapolis.
NUMERICAL OPERATIONAL METHODS IN STRUCTURAL DYNAMICS Ph.D. Thesis
Ganapathy Venkata Narayanan 1980 298 p
Avail: Univ. Microfilms Order No. 8019552

A general and systematic discussion on the use and importance of the operational method of Laplace transform for determining the response of large linear dynamic systems governed by partial or ordinary differential equations of the second order with respect to time is presented. The Laplace transform technique,

when applied on these equations with respect to time, reduces the dynamic problem to a state one, which can be solved in the transform plane by any covenient numerical method such as the finite element, finite difference or boundary integral method. The final solution or response of the dynamic system is obtained by a numerical inversion of the transformed solution. Various existing methods of numerical inversion of Laplace transform, selected on the basis of their generality, accuracy and computational efficiency, are reviewed and critically discussed in great detail. Two groups of numerical examples from the area of structural vibrations are presented in detail to illustrate the application of these numerical operational methods.
Dissert. Abstr.

N80-30784 Princeton Univ., N. J.
APPLICATION OF A ROOT LOCUS TECHNIQUE TO MULTILOOP VELOCITY OUTPUT FEEDBACK VIBRATION SUPPRESSION CONTROLLERS Ph.D. Thesis
Daniel Croel Herrick 1980 150 p
Avail: Univ. Microfilms Order No. 8018660

This technique is a generalization of the classical single input single output root locus. Formulas are developed for the root behavior of the structural equation when the damping matrix is either small or large. Low gain root behavior termed departure rates in the neighborhood of the natural frequencies of vibration, are given by a matrix perturbation equation. Formulas for high gain behavior describe the possible limiting migration patterns for damped structural poles called finite zero, infinite zero asymptotes and origin zero arrival directions. The predictability of root behavior for intermediate levels of gain based on the root locus formulas is examined. Some matrix prescription based on the root locus formulas are tested. The root locus approach is tested with several sample structures, the most complicated comprising twelve resonant modes. Some of the mathematical techniques that underlie the root locus technique are applied to the calculation of frequency response fixed points.Dissert. Abstr.

N80-30785*# National Aerospace Lab., Amsterdam (Netherlands).
MINITWIST, A SHORTENED VERSION OF TWIST
H. Lowak, J. B. de Jonge, J. Franz, and D. Schuetz 1 May 1979 27 p refs Prepared in cooperation with Lab. fuer Betriebsfestigkeit, Darmstadt, West Germany
(NLR-MP-79018-U; ICAF-1147; LBF-TB-148) Avail: NTIS HC A03/MF A01

A description of the shortened version of the Transport Wing Standard Program (TWIST) is given. In all cases where testing time is a prohibitive factor to use TWIST, it is proposed to use this shortened program. The user of this shortened program should be aware that in most cases the load cycles with high frequency and low amplitude omitted in MINITWIST would contribute to damage; thus the results will overestimate the fatigue life. T.M.

N80-30786# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
NON-CONTACTING STRAIN CONTROL AND ACOUSTIC EMISSION IN HIGH-TEMPERATURE TESTING
H. Fuhring [1979] 10 p refs
(ICAF-1142) Avail: NTIS HC A02/MF A01

Methods and accuracy of longitudinal strain control tests of smooth cylindrical specimens, crack initiation detection, and high temperature testing using acoustic emissions are described. T.M.

N80-30787*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LATERAL DENSITY VARIATIONS IN ELASTIC EARTH MODELS FROM AN EXTENDED MINIMUM ENERGY APPROACH
Braulio V. Sanchez Jun. 1980 29 p refs Submitted for publication
(NASA-TM-80742) Avail: NTIS HC A03/MF A01 CSCL 08M

Kaula's minimum energy approach was extended to include the nonhydrostatic gravitational potential energy and the density perturbation field was obtained to degree and order eight. The depth profiles for the density perturbation show a stratification with density excesses and deficiencies alternating with depth. The addition of the gravitational potential energy in the minimization process does not change significantly the conclusions based on results for the minimum shear strain energy case, concerning the inability of the mantle to withstand the lateral loading elastically. T.M.

N80-30788# Metcut Research Associates, Inc., Cincinnati, Ohio.
CRITICALLY LOADED HOLE TECHNOLOGY ADVISORY GROUP FOR AEROSPACE RESEARCH AND DEVELOPMENT Final Report, 27 Dec. 1977 - 27 Oct. 1979
John B. Kohls, Stephen C. Ford, and George Roth Wright-Patterson AFB, Ohio AFML Mar. 1980 135 p Prepared in cooperation with Battelle Columbus Labs., Ohio and Dayton Univ. Research Inst., Ohio
(Contract F33615-78-C-5030)
(AD-A088021; AFWAL-TR-80-4027; Rept-970-26000-1) Avail: NTIS HC A07/MF A01 CSCL 11/6

A pilot test program was conducted which consisted of a coordinated test activity between interested AGARD SMP member countries. The program leads to a more uniform attitude toward fatigue testing and evaluation of critically loaded hole parameters among its participants. This report describes the U.S. portion of the test program. The report includes both open hole and low load transfer joint testing of specimens having both high and low quality test holes. The quality level of the holes was based primarily on cost. The report also includes a technique for verifying the loading accuracy of the spectrum fatigue equipment used by each of the participants. GRA

N80-30789# Dayton Univ., Ohio.
QUICK REACTION EVALUATION OF MATERIALS FOR SYSTEMS APPLICATIONS Final Temperature Report, 3 Jan. 1978 - 31 Mar. 1980
D. R. Askins, R. R. Cervay, D. L. Hart, and B. H. Wilt Wright-Patterson AFB, Ohio AFML Apr. 1980 372 p refs
(Contract F33615-78-C-5002; AF Proj. 2421)
(AD-A085859; UDR-TR-80-12; AFWAL-TR-80-4025) Avail: NTIS HC A15/MF A01 CSCL 11/4

This report is divided into four sections summarizing the engineering studies completed under contract to the Air Force Wright Aeronautical Laboratories, Materials Support Division. A variety of materials evaluations were completed under the categories of Alloys and Composites, Electronic Failure Analysis, Elastomers, and Plastics, Adhesives, and Composites. GRA

N80-30790# Ceramic Finishing Co., State College, Pa.
LOCALIZED IMPACT DAMAGE IN CERAMICS. LOCALIZED IMPACT DAMAGE IN ZINC SULFIDE CRACK GROWTH FROM SMALL FLAWS IN LARGER GRAINS IN ALUMINA Technical Report, 1 Feb. 1979 - 31 Jan. 1980
H. P. Kirchner, T. J. Larchuk, and J. M. Ragostra Feb. 1980 104 p
(Contract N00014-74-C-0241)
(AD-A085874; TR-8) Avail: NTIS HC A06/MF A01 CSCL 11/2

The following topics are covered in this report (1) localized impact damage in zinc sulfide, and (2) crack growth from small flaws in larger grains in alumina. Zinc sulfide specimens were damaged by static and impact loading using glass spheres. The various types of cracks were identified and their size were measured. The maximum impact loads were estimated by several methods including an experimental method based on the assumption that static and impact loads are equal at equal indentation radii, a semiempirical method previously developed on this program and a method suggested by Hutchings. Crack growth in alumina was simulated for the case of small flaws in larger surface crystals to determine the range of crystal sizes and loading rates in which single crystal fracture energies would be expected to control fracture. This should be expected only for large crystals and very high loading rates. GRA

N80-30791# Terra Tek, Inc., Salt Lake City, Utah.
EVALUATION OF A NEW FRACTURE TOUGHNESS MEASURING TECHNIQUE, AND ADAPTATION OF THE TECHNIQUE TO USE ULTRA-SMALL SPECIMENS Final Report
Lynn M. Barker Sep. 1979 54 p refs
(Contract DAAG46-78-C-0040; DA Proj. 1L1-62105-AH-84)
(AD-A085892; AMMRC-TR-79-53) Avail: NTIS

HC A04/MF A01 CSCL 11/6

Three separate investigations were undertaken to determine the applicability of the short rod fracture toughness measurement method to materials such as HF1 fragmentation steel, which is of particular interest to the Army. In the first study, short rod fracture toughness (K sub Ic SR) measurements were compared with ASTM E 399 measurements of toughness (K sub Ic) in a number of metallic materials. Very good agreement was found. In the second study, the methods of fabricating and testing ultrasmall short rod specimens (6.35 mm diameter) were developed and used in measurements of HF1 material taken from actual shell casings. The agreement of the ultrasmall short rod measurements with the toughness as measured by precracked charpy specimens of the same material was rather poor. The third study was made to determine the sensitivity of the short rod toughness measurement to the size of the specimen used in the test. Short rods of various sizes of 4340 steel and two heat treatments of HF1 steel were tested. The specimen size independence of the 4340 steel was marginal, but it was excellent for the HF1 steel. A trend toward an increasing scatter in K sub IC SR data with decreasing specimen size was noted. Recommendations for decreasing the data scatter and automating the test are made. GRA

N80-30792# Rockwell International Corp., Columbus, Ohio. Missiles Systems Div.

NUMERICAL ESTIMATION OF STRESS INTENSITY FACTORS BY A FINITE DIFFERENCE EULERIAN METHOD (THE HELP CODE) Final Report

M. S. Chawla and J. A. Zukas Aberdeen Proving Ground, Md. Ballistics Research Labs. Apr. 1980 38 p refs

(Contract DAAD05-77-C-0139)

(AD-A086111; AD-E430460; ARBRL-CR-00426) Avail: NTIS HC A03/MF A01 CSCL 19/4

A finite difference Eulerian code, HELP, is employed to study the stress enhancement effects in the vicinity of a crack tip in a rectangular plate which is subjected to a sudden uniaxial loading in the plane strain geometry. The results are in excellent agreement with those obtained from other methods. This demonstrates the usefulness and accuracy of the HELP code in simulating dynamic problems of fracture mechanics. GRA

N80-30793# State Univ. of New York at Buffalo. Dept. of Engineering Science, Aerospace Engineering and Nuclear Engineering.

TORSIONAL WAVES IN A BIMETALLIC CYLINDER. PART 1: AXIALLY HOMOGENEOUS CASE

R. K. Kaul, R. P. Shaw, and W. Muller Oct. 1979 43 p refs

(Contracts N00014-75-C-0302; N00014-71-C-0108)

(AD-A085822; Rept-107) Avail: NTIS HC A03/MF A01 CSCL 20/11

The dispersion spectrum is found for axially symmetric torsional waves in an elastic, bimetallic rod with cylindrical core and concentric outer casing. Plotting of the various branches of the spectrum is simplified by the presence of discrete invariant points which are independent of the material properties, and through which the spectral lines must pass. The slope and curvature of the spectral lines at cutoff frequencies, the asymptotic approximations at high frequency, the nonexistence of complex branches, the problem of coexistence and the concept of energy flow are also studied. GRA

N80-30794# George Washington Univ., Washington, D.C. School of Engineering and Applied Science.

A COMPARATIVE STUDY ON THE ELASTIC-PLASTIC COLLAPSE STRENGTH OF INITIALLY IMPERFECT DEEP SPHERICAL SHELLS

Robert Kao Feb. 1980 42 p refs

(Contract N00014-75-C-0946)

(AD-A086006) Avail: NTIS HC A03/MF A01 CSCL 13/13

A finite-difference method for the large deformation elastic-plastic analysis of spherical caps is applied to predict the collapse strength of initially imperfect deep spherical shells. Twelve uniformly loaded hemispherical shell models with flat spots at their apex are analyzed. For each model, a number of shallow spherical regions containing the flat spot are selected from its domain. One of these selected shallow regions yields a minimum buckling pressure; this minimum value is taken as the theoretical buckling load for the shell model under consideration. Present solutions are in good agreement with existing experimental and empirical results. The good comparison suggests that initially imperfect deep spherical shells may be analyzed by using a much simpler mathematical model - the spherical cap, and thus the analytical cost may be greatly reduced. This also demonstrates that the collapse of imperfect spherical shells is primarily a local phenomenon and therefore dependent on local geometry. Consequently, the presence of initial imperfections must be fully taken into consideration in any large deformation inelastic buckling analysis before such analysis can be expected to quantitatively predict the collapse strength of practical shell structures. GRA

N80-30795# Dayton Univ., Ohio. Aerospace Mechanics Div.

A REVIEW OF NONLINEAR FRACTURE RELATIVE TO FATIGUE Final Report, Sep. 1978 - Sep. 1979

T. Weerasooriya, J. P. Gallagher, and H. C. Rhee 30 Sep. 1979 85 p refs

(Contract F33615-78-C-5184; AF Proj. 2418)

(AD-A086671; UDR-TR-79-99; AFML-TR-79-4196) Avail: NTIS HC A05/MF A01 CSCL 20/11

This report reviews currently available parameters, methodology, and data that support further developments in elastic-plastic fracture mechanics (EPFM) technology for modeling fatigue crack growth rate (FCGR) behavior. In general, it can be stated that linearly elastic fracture mechanics (LEFM) parameters can be used to model FCGR behavior except when the zone of cyclic plasticity accompanying the crack process is large with respect to crack length and other structural length parameters. The literature provides two types of EPFM parameters which are available for modeling FCGR behavior when the limitations of LEFM are exceeded: one type is based on the characterization of the intensity of the crack tip stress-strain field, the other is based on the determination of a specific mechanical parameter which is evaluated at a point close to the crack tip. GRA

N80-30796# Vought Astronautics, Dallas, Tex.

FATIGUE AND FRACTURE OF ULTRAHIGH STRENGTH STEEL AND TITANIUM ROLL BONDED AND DIFFUSION BONDED LAMINATES Final Report, 25 Sep. 1978 - 25 Mar. 1980

L. E. Sloter and D. H. Peterson May 1980 79 p refs

(Contract N00019-78-C-0491)

(AD-A086511; ATC-R-9200/OCR-31) Avail: NTIS HC A05/MF A01 CSCL 11/6

The results of the fabrication by roll bonding of metal-metal laminates and the fatigue and fracture toughness testing of these laminates are reported and discussed. Laminate panels have been prepared from layers of steel alloy 300M interleaved with thin layers of two carbon steels and an ultrahigh carbon steel and from Ti-10V-2Fe-3Al interleaved with Ti-15V-3Cr-3Al-3Sn by roll bonding and from Ti-6Al-4V interleaved with commercially pure titanium by diffusion bonding. Both the steel and titanium alloys were heat treated such that their maximum strengths were obtained. Through proper selection of interleaf alloys (thin layers of material bonded between primary layers of the principal alloy) and heat treatment, critical fracture toughness properties were improved by over 100% over the monolithic values at ultimate strength levels of 290 ksi (1999 MPa) for the 300M steel and 190 ksi (1310 MPa) for the Ti-10V-2Fe-3Al. This improvement brought the toughness at these strength levels to values acceptable for damage tolerant service in aerospace structures or other structures requiring high fracture toughness at high strength levels. Furthermore, the fatigue strength of simulated flawed structural items machined from laminated plate was demonstrated to be superior to the equivalent monolithic material for both the steel and titanium alloys. GRA

N80-30797# Princeton Univ., N. J. Dept. of Civil Engineering.

NONLOCAL STRESS FIELD AT GRIFFITH CRACK

N. Ari and A. Cemal Eringen Jun. 1980 28 p refs

(Contract N00014-76-C-0240; NR Proj. 064-410)

(AD-A086496; Rept-80-SM-7; TR-54) Avail: NTIS HC A03/MF A01 CSCL 20/11

By means of nonlocal elasticity theory, the Griffith crack problem is solved to determine the state of stress in a plate weakened by a line crack. The maximum stress is found to be

finite and occurs away from the crack tip. Cohesive stress is estimated and compared with the calculations based on atomic lattice theory. GRA

N80-30798# Wisconsin Univ. - Madison. Mathematics Research Center.

A DECOMPOSITION PROCEDURE FOR LARGE SCALE OPTIMAL PLASTIC DESIGN PROBLEMS Technical Summary Report

Ikuyo Kaneko and Cu Duong Ha May 1980 30 p refs

(Contracts DAAG29-75-C-0024; DAAG29-80-C-0041)

(AD-A086560; MRC-TSR-2075) Avail: NTIS HC A03/MF A01 CSCL 12/1

A decomposition procedure is proposed in this paper for solving a class of large scale optimal design problems for perfectly plastic structures under several alternative loading conditions. The conventional finite element method is used to cast the problem into a finite dimensional constrained nonlinear programming problem. Structures of practically meaningful size and complexity tend to give rise to a large number of variables and constraints in the corresponding mathematical model. The difficulty is that the state-of-the-art Mathematical Programming theory does not provide reliable and efficient ways of solving large scale constrained nonlinear programming problems. The natural idea to deal with the large scale structural problem is to somehow decompose the problem into an assembly of small size problems each of which represents an analysis of the behavior of each finite element under a single loading condition. This paper proposes one such way of decomposition based on the duality theory and a recently developed iterative algorithm. GRA

N80-30799# Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.

THE SURFACE SINGULARITY OF CRACKS Interim Report

Zdenek P. Bazant and Luis F. Estenssoro Oct. 1979 162 p refs Submitted for publication

(Grant AF-AFOSR-2859-75; AF Proj. 2307)

(AD-A086491; Struct-Eng-79-10/2515; AFOSR-80-0457TR) Avail: NTIS HC A08/MF A01 CSCL 20/11

The three dimensional singular stress field near the terminal point 0 of the crack front edge at the surface of an elastic body is investigated. The variational principle governing the displacement distribution on a unit sphere about point 0 is derived from the differential equations of equilibrium, and more directly, from the potential energy. By energy flux arguments it is found that the front edge of a propagating crack must terminate at the surface obliquely at a certain angle, whose dependence upon the inclination of a crack plane is also solved. The angle is the same for Modes 2 and 3, but different for Mode 1. For Mode 1, the surface point trails behind the interior of the propagating crack, while for Modes 2 and 3 it moves ahead. Consequently, a combination of Mode 1 with Modes 2 and 3 is impossible at the surface terminal point of a propagating crack whose plane is orthogonal. When the plane is inclined, the three intensify factors can combine only in certain fixed ratios. The crack edge angle is a function of the angle of the crack plane. Some results are also presented for notches and for cracks that intersect a two material interface. E.D.K.

N80-30800# California Univ., Berkeley. Dept. of Mechanical Engineering.

ON THE CHARACTERIZATION OF STRAIN-HARDENING IN PLASTICITY

J. Casey and P. M. Naghdi May 1980 47 p refs

(Contract N00014-75-C-0148; NR Proj. 064-436)

(AD-A086551; UCB/AM-80-5) Avail: NTIS HC A03/MF A01 CSCL 20/11

In the context of a purely mechanical, rate-type theory of elastic-plastic materials and utilizing a strain space formulation, this paper is concerned mainly with developments pertaining to strain-hardening behavior consisting of three distinct types of material response, namely hardening, softening and perfectly plastic behavior. It is shown that such strain-hardening behavior may be characterized by a rate-independent quotient of quantities occurring in the loading criteria of strain space and the corresponding loading conditions of stress space. With the use of special constitutive equations, the predictive capability of the results obtained are illustrated for strain-hardening response and saturation hardening in a uniaxial tension test. GRA

N80-30801# Washington Univ., Seattle. Dept. of Mechanical Engineering.

INFLUENCE OF SMALL SCALE YIELDING ON DYNAMIC FRACTURE Interim Report

A. S. Kobayashi, M. Ramulu, and B. S-J. Kang May 1980 21 p refs

(Contract N00014-76-C-0060; NR Proj. 064-478)

(AD-A086335; TR-38) Avail: NTIS HC A02/MF A01 CSCL 20/11

Dynamic fracture and crack-arrest responses of the well-discussed wedge-loaded rectangular, double cantilever beam (WL-RDCB) specimens machined from a 3.2 mm thick annealed polycarbonate sheet were studied by dynamic photoelasticity and dynamic finite element analysis. A small, but finite plastic yield zone surrounded the propagating crack which resulted in crack velocities, dynamic fracture toughness and crack arrest toughness lower than those observed previously in 6.4 mm thick polycarbonate fracture specimens. GRA

N80-30802# Wisconsin Univ. - Madison. Mathematics Research Center.

AN INTEGRAL BOUND ON THE STRAIN ENERGY FOR THE TRACTION PROBLEM IN NONLINEAR ELASTICITY WITH SMALL STRAINS

Joseph J. Roseman (Tel-Aviv Univ.) Apr. 1980 20 p refs

(Contracts DAAG29-75-C-0024; DAAG29-80-C-0041; Grant DAAG29-76-G-0102)

(AD-A086377; MRC-TSR-2060) Avail: NTIS HC A02/MF A01 CSCL 20/11

For the traction boundary value problem in nonlinear elastostatics for a body which is convex in its undeformed reference state and with the assumption of sufficiently small strains (but not necessarily small displacement gradients), an upper bound is obtained for the elastic strain energy in terms of the L sub 2-integral norms of the surface tractions and body forces with the constant depending only upon the ratio of the outer and inner diameters and the physical constants of the material. This result extends previous known results in linear elasticity (infinitesimal displacement gradients) and finite elasticity (small but finite displacement gradients) into the small strain theory of nonlinear elasticity. GRA

N80-30803# Air Force Materials Lab., Wright-Patterson AFB, Ohio. Mechanics and Surface Interactions Branch.

CURING STRESS FIELDS IN INVOLUTE EXIT CONES Final Report, 1 Nov. 1979 - 15 Feb. 1980

N. J. Pagano Feb. 1980 58 p refs Prepared in cooperation with Prototype Development Associates, Inc., Santa Ana, Calif. (AF Proj. 2419)

(AD-A086404; AMFL-TR-79-4191) Avail: NTIS HC A04/MF A01 CSCL 20/11

A procedure is developed for determining the unusual distribution of ply material in an involute exit cone and then it is used in an analysis of the curing stresses in an IUS exit cone billet. The ply pattern analysis produces three Euler angles at each material point that are used to define properties for a finite element model of the billet. Attention is focused on the delamination failure mode observed during post cure and large regions of cross-ply tension are shown to occur during cool down. Comparisons with autopsy data show that the predicted ply fiber distribution is in good agreement with that observed in the IUS billet, while the finite element stress pattern seems to correlate with observed cracking patterns. Finally, a sensitivity study shows a striking dependence of the interlaminar normal stress on the orientation of the ply pattern on the cloth. GRA

N80-30804# Clarkson Coll. of Technology, Potsdam, N.Y. Dept. of Mechanical and Industrial Engineering.

OPTIMALITY CRITERION TECHNIQUES APPLIED TO STRUCTURES COMPOSED OF DIFFERENT ELEMENT TYPES Technical Report, Sep. 1978 - May 1980

M. I. Syed, K. D. Willmert, and M. R. Khan 1980 10 p refs Presented at the 21st AIAA/ASME Struct., Structural Dyn. and Mater. Conf., Seattle, 12-14 May 1980

(Contract N00014-76-C-0064)

(AD-A086644; MIE-059) Avail: NTIS HC A02/MF A01 CSCL 11/4

The optimality criterion design method, developed by Khan, Willmert and Thornton which exploits the concept of one most critical constraint, has been extended in this paper to handle more complex structures, specifically ones composed of several different types of elements. The elements considered were the truss, and two different plane stress elements: a constant strain triangular element and a rectangular symmetric shear panel. The optimality criterion method treats multiple load conditions and stress and displacement constraints. A wing-box structure is considered as an example to demonstrate the efficiency and simplicity of the method. GRA

N80-30805# Lincoln Lab., Mass. Inst. of Tech., Lexington.
AN ASTRONOMICAL GLOSSARY
Laurence G. Taff 12 Feb. 1980 105 p
(Contract F19628-80-C-0002; AF Proj. 3221)
(AD-A084445; ETS-52; ESD-TR-79-328) Avail: NTIS HC A06/MF A01 CSCL 03/1

At various times during the development of the GEODSS system it became clear that a common, technical vocabulary could be a useful thing. There are many precisely defined astronomical quantities one needs to intelligently discuss star catalogs, optical data reduction, orbital analysis, photometry, etc. Partially as an outgrowth of this need, but mostly through the impetus of a forthcoming reference work, this Glossary was assembled. Its orientation is heavily toward astrometry, rather than astronomy or astrophysics. Also, it is frequently difficult to give precise and concise definitions. In some cases, it is impossible to provide the precise meaning without complicated formulas and much discussion. Nevertheless, sometimes sacrificing clarity for brevity and with a minimum of mathematics, the following 800 items are presented. GRA

N80-30806# Forest Products Lab., Madison, Wis.
LAMINATED BEAMS OF ISOTROPIC OR ORTHOTROPIC MATERIALS SUBJECTED TO TEMPERATURE CHANGE
Shun Cheng and T. Gerhardt (Westvaco Corp., Covington, Va.) Jun. 1980 31 p refs
(AD-A087230; FSRP-FPL-375) Avail: NTIS HC A03/MF A01 CSCL 13/13

This paper considers laminated beams with layers of different isotropic or orthotropic materials fastened together by thin adhesives. The stresses that result from subjecting each component layer of the beam to different temperature or moisture stimuli which may also vary along the length of the beam, are calculated. Two dimensional elasticity theory is used so that a wide range of problems, such as that of beams composed of layers of orthotropic materials like wood, can be studied, and accurate distributions of normal and shear stresses obtained. The stress intensity along the bearing surfaces of the layers of the beam is of particular importance because it is responsible for delamination failures of laminated structural elements. The distributions of interlaminar normal and shear stresses measured along the longitudinal axis of the beam indicate that high stress intensity occurs in the end zones of the beam. Thus, delamination failure, when it occurs, will start at the end of the beam. GRA

N80-30807# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Automatic Data Processing Center.
A THREE-DIMENSIONAL STABILITY ANALYSIS/DESIGN PROGRAM (3DSAD). REPORT 1. GENERAL GEOMETRY MODULE
Fred T. Tracy Jun. 1980 47 p
(AD-A087074; WES-INSTRUCTION-K-80-4) Avail: NTIS HC A03/MF A01 CSCL 13/13

This module of the three dimensional stability analysis/design program (3DSAD) enables the engineer to describe the geometry of a three dimensional structure, to interactively plot the desired structure, and then to obtain volume, weight, and centroid information for the structure. The general ways in which geometry is described are (a) two dimensional cross sections extended in the third dimension, (b) eight-node brick elements, and (c) clusters of planar polygonal patches. Curved segments can be either circular, elliptical, or quadratic. Hidden lines in a view can be either deleted or dashed. GRA

N80-30808# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Geotechnical Lab.
PAVEMENT EVALUATION AND OVERLAY DESIGN USING VIBRATORY NONDESTRUCTIVE TESTING AND LAYERED ELASTIC THEORY. VOLUME 1: DEVELOPMENT PROCEDURE Final Report, Oct. 1977 - Dec. 1978
Richard A. Weiss Mar. 1980 175 p refs
(Contract DOT-FA73WAI-377)
(AD-A087186; FAA-RD-77-186-Vol-1) Avail: NTIS HC A08/MF A01 CSCL 01/5

A procedure is developed for determining the allowable load carrying capacities and the required overlay thicknesses of airport pavements. A layered elastic theory approach is used with vibratory nondestructive tests supplying the dynamic responses of pavements. For a given pavement, a computer program SUBE is used to determine the value of the subgrade Young's modulus from the measured dynamic responses, and a computer program PAVEVAL, which is based on the layered elastic theory, is used to calculate the allowable load carrying capacity and the required overlay thickness. Limiting subgrade strains and horizontal stresses in pavement layers are used as criteria for determining load carrying capacities and overlay thickness requirements. Single and multiple wheel loadings are considered. Volume 2 of this report presents a validation of these procedures for three airport sites. GRA

N80-30809# Army Armament Research and Development Command, Watervliet, N. Y. Large Caliber Weapon Systems Lab.
STRESS CONCENTRATIONS IN SCREW THREADS
G. P. OHara Apr. 1980 47 p refs Presented at the NASTRAM Users Colloq., Greenbelt, Md., Oct. 1979
(AD-A087218; AD-E440073; ARLCB-TR-80010) Avail: NTIS HC A03/MF A01 CSCL 13/5

The concept of stress concentration in screw threads is defined as a ratio of maximum fillet stress normalized to shear transfer rate. The data is presented as a plot of fillet stress vs. radial stress for a particular thread form. The Heywood equation is used to generate the basic plots and NASTRAN is used to extend the analysis to the case both where flanks of an individual thread tooth are in contact and the case where a finite axial stress is superimposed. GRA

N80-30810# Naval Research Lab., Washington, D. C. Material Science and Technology Div.
PIPING INELASTIC FRACTURE MECHANICS ANALYSIS
C. I. Chang, M. Nakagaki, C. A. Griffis, and R. A. Masumura 30 Jun. 1980 92 p refs
(Contract NRC-03-79-116)
(AD-A087002; AD-E000493; NRL-MR-4259; NUREG-CR-1119) Avail: NTIS HC A05/MF A01 CSCL 20/11

Available experimental data and the analytical methods for predicting rupture of LWR piping are assembled and assessed. The analytical techniques investigated can be catalogued into three major groups: structural response, semiempirical methods, and the J-controlled growth approach. A leak-before-break condition is also investigated. GRA

N80-30811# Naval Research Lab., Washington, D. C. Metals Performance Branch.
OBSERVATIONS ON THE GENERALITY OF THE GRAIN-SIZE EFFECT ON FATIGUE CRACK GROWTH IN ALPHA PLUS BETA TITANIUM ALLOYS Final Report
G. R. Yoder, L. A. Cooley, and T. W. Crooker 19 May 1980 13 p refs
(RR0220148)
(AD-A087215; AD-E000479; NRL-MR-4232) Avail: NTIS HC A02/MF A01 CSCL 20/11

Results obtained through analysis of the literature agree with those of our own as regards the effect of grain size (l) on region-II fatigue crack growth rates (da/dN) of alpha - beta titanium alloys in ambient air, viz. that for a given value of stress intensity range (delta kappa), da/dN decreases as (l) is increased. The analysis indicates that when microstructural modification of a given alloy affects a reduction in da/dN, the reduction appears attributable to an increase in l. Conversely, when microstructural modification fails to affect a significant

change in da/dN, the result appears attributable to a negligible change in I. Comparison of fatigue crack growth behavior at stress intensity ranges of 15, 21 and 40 MPa square root m indicates a diminution of the grain size effect with increased delta kappa. As elucidated in terms of the reversed plastic zone size model, diminution of the grain size effect follows as a consequence of the reduced portion of the structure sensitive mode of crack growth present as delta kappa is increased. GRA

N80-30812# Texas A&M Univ., College Station. Dept. of Aerospace Engineering.

THE PREDICTION OF RESPONSE OF SOLIDS TO THERMAL LOADING USING THE FINITE ELEMENT CODE AGGIE 1 Interim Report

David H. Allen and Walter E. Haisler 30 May 1980 53 p refs

(Contract N00014-76-C-0150; NR Proj. 064-534)

(AD-A087042; TR-3275-80-1) Avail: NTIS HC A04/MF A01 CSCL 20/11

In previous work the authors have proposed a theory of predicting the response of elastic plastic solids subjected to thermal loads. The theory was cast in a finite element framework and has now been placed in the finite element code AGGIE I. In this paper several example problems will be compared to experimental and other theoretical results. It will be shown that the model in its current form is adequate for modelling the response of many solids composed of temperature dependent materials. GRA

N80-30813# Old Dominion Univ., Norfolk, Va. Dept. of Mathematics.

FRACTURE PROBLEMS IN POWER LAW VISCOELASTIC MATERIALS Final Report, 1 Jun. 1979 - 30 Jun. 1980

Arje Nachman Jun. 1980 25 p refs

(Contract F49620-79-C-0076; AF Proj. 2304)

(AD-A087244; AFOSR-80-0562TR) Avail: NTIS HC A02/MF A01 CSCL 20/11

Two papers were completed during the contract year. They are appended to this report. The first has been accepted for publication the International Journal of Solids and Structures. The second has recently been submitted to the same journal. Both papers concern themselves with the general issue of debonding. In each paper loading criteria were exhibited under which an interface edge crack between dissimilar elastic media would propagate. It was felt that these questions must be settled for the elastic case before an intelligent approach to the viscoelastic case could be possible. Moreover, several very interesting viscoelastic debonding problems have recently been formulated by the author, so the general program outlined in the contract will be carried forward. GRA

N80-30814# George Washington Univ., Washington, D.C. Dept. of Civil Mechanical and Environmental Engineering.

NONLINEAR CREEP BUCKLING ANALYSIS OF INITIALLY IMPERFECT SHALLOW SPHERICAL SHELLS

Robert Kao Jul. 1980 51 p refs

(Contract N00014-75-C-0946)

(AD-A087017) Avail: NTIS HC A04/MF A01 CSCL 20/11

Creep buckling times and creep deformations are obtained for axisymmetric shallow spherical shells with and without initial imperfections. For nonlinear creeps, both strain hardening and time hardening rules are employed in the analysis; results indicate that strain hardening yields better estimates of shell life than time hardening. Results also show that the initial imperfection plays an important role in shortening shell creep buckling times. GRA

N80-30815# Argonne National Lab., Ill. Reactor Analysis and Safety Div.

ACCURATE NUMERICAL SOLUTIONS FOR ELASTIC-PLASTIC MODELS

H. L. Schreyer, R. F. Kulak, and J. M. Kramer Mar. 1980 27 p refs

(Contract W-31-109-eng-38)

(ANL-80-31) Avail: NTIS HC A03/MF A01

The accuracy of two integration algorithms is studied for the common engineering condition of a von Mises, isotropic hardening model under plane stress. Errors in stress predictions for given total strain increments are expressed with contour plots of two parameters: an angle in the pi plane and the difference between the exact and computed yield surface radii. The two methods are the tangent predictor/radial return approach and the elastic predictor/radial corrector algorithm originally developed by Mendelson. The accuracy of a combined tangent predictor/radial corrector algorithm is also investigated. DOE

N80-30816# Oak Ridge National Lab., Tenn.

DETERMINATION OF K-FACTORS FOR ARBITRARILY SHAPED FLAWS AT PRESSURE VESSEL NOZZLE CORNERS

J. W. Bryson 1979 20 p refs Presented at the 7th Water Reactor Safety Res. Inform. Meeting, Gaithersburg, Md., 5 Nov. 1979

(Contract W-7405-eng-26)

(CONF-791118-11) Avail: NTIS HC A02/MF A01

Photoelastic and finite elements studies are being conducted to determine Mode I stress intensity factor distributions along arbitrarily shaped flaw fronts at pressure vessel nozzle corners. Comparisons of results from NOZ-FLAW, BIGIF, and the photoelastic studies showed that (1) good agreement was obtained between NOZ-FLAW and the photoelastically determined K sub 1s for the deep flaw in an ITV model, (2) good agreement was obtained between NOZ-FLAW BIGIF for shallow and moderately deep flaws in a BWR model, and (3) less satisfactory agreement was obtained between NOZ-FLAW and the photoelastic results for the BWR models, particularly for moderately deep to deep flaws. Attempts are presently being made at understanding and explaining the discrepancies between the two. DOE

N80-30817# Argonne National Lab., Ill. Components Technology Div.

USE OF ENDOCHRONIC PLASTICITY FOR MULTI-DIMENSIONAL SMALL AND LARGE STRAIN PROBLEMS

B. J. Hsieh Apr. 1980 103 p refs

(Contract W-31-109-eng-38)

(ANL-CT-79-19) Avail: NTIS HC A06/MF A01

The endochronic plasticity theory, proposed in its general form by K. C. Valanis, is investigated. The explicit forms of the constitutive equation resemble closely those of the classical theory of linear viscoelasticity. Excellent agreement between the predicted and experimental results is obtained for some metallic and nonmetallic materials for one dimensional cases. Explicit constitutive equations are derived that are consistent with the general theory for one dimensional (simple tension or compression), two dimensional plane strain or stress, and three dimensional axisymmetric problems. DOE

N80-30818# Illinois Inst. of Tech., Chicago. Dept. of Mechanics and Mechanical and Aerospace Engineering.

STUDY OF THE INTERACTIONS BETWEEN FRICTION, WEAR AND SYSTEM RIGIDITY Progress Report, 1 Jul. 1979 - 30 Jun. 1980

V. Aronov, A. F. DSouza, S. Kalpakjian, and I. Shareef Mar. 1980 52 p refs

(Contract DE-AC02-79ER-10471)

(DOE/ER-10471/1) Avail: NTIS HC A04/MF A01

Progress in friction and wear studies is reported. After an extensive study of various possible systems for friction, wear and vibration measurements, a pin and disk sliding system was designed to be used on a rigid lathe bed. This versatile design has the capability of controlling the applied load, rigidity and damping of the total frictional system. The design and construction of the pin holding assembly were completed with certain features to render it suitable for acquisition of appropriate data such as forces and displacements. Special instrumentation was obtained; the major components of which are a tri-axial quartz piezoelectric force transducer, a tri-axial ceramic piezoelectric accelerometer for measurements of vibrations of the slider, charge preamplifiers with dc power supply, and monitoring equipment such as a spectral analyzer and an oscillograph. Preliminary experiments indicate that the system is appropriate for the type of study undertaken. Some preliminary experimental results are included. DOE

N80-30819# Oxford Univ. (England). Dept. of Engineering Sciences.

DYNAMIC MEASUREMENTS OF MICROPOLAR ELASTIC CONSTANTS
W. E. Jahsman (Colorado Univ., Boulder) and R. D. Gauthier (Colorado School of Mines) 1979 47 p refs
(OUEL-1291/91) Avail: NTIS HC A03/MF A01

A series of dynamic tests utilizing a compression type Kolsky apparatus was conducted. Short cylindrical specimens machined from bulk composite material were subjected to short duration compressive pulses. Similar tests were conducted on specimens of the constituent materials of the composite. Differences are observed between the records for the constituent materials and for the composite specimen. The records for the constituents are smooth and compared well with predictions based on one dimensional wave propagation through homogeneous isotropic elastic solids. The record for the composite materials exhibit high frequency ripples which no reasonable adjustment in the averaged material properties can explain. Analysis shows that in addition to the classical Rayleigh-Lamb frequency equations, an independent set of micropolar frequency equations is generated. By associating the fundamental and first harmonic of the micropolar frequencies with the high frequency ripples appearing on the measured signal for the composite, it is possible to calculate two of the four micropolar elastic constants for the material. On the basis of these results, it is concluded that for certain composites dynamic measurements can provide the resolution needed to determine at least some of the micropolar elastic constants. Author (ESA)

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N80-30820 Cornell Univ., Ithaca, N. Y.
AN OPTIMAL STATE ESTIMATION ALGORITHM FOR TERRAIN-RANGING SYSTEMS Ph.D. Thesis
Won Teh Hwang 1980 95 p
Avail: Univ. Microfilms Order No. 8020831

A simple recursive algorithm for continuous dynamic positional state estimation referenced to a moving vehicle equipped with the above image mapping systems is developed by making use of optimal and suboptimal Kalman filters and minimization techniques of the least squares loss function subject to constraints of budget simplicity, and survivability in hostile environment. The applied theories are mainly the theories of system and optimal control with some broad understanding of navigation and electrooptics. The general objective of the algorithm are to make selected measurements of the outputs of the image mapping systems to minimize the trace of the resulting error covariance matrix of the state estimates and also to make selections such that the error covariances of the estimates of unmeasured quantities be small. A performance index for use in the algorithm is developed and evaluated. Dissert. Abstr.

N80-30821 California Inst. of Tech., Pasadena.
DEGRADATION OF PICTURE QUALITY BY SPECKLE IN COHERENT MAPPING SYSTEMS Ph.D. Thesis
Vuaya Narayan Korwar 1980 183 p
Avail: Univ. Microfilms Order No. 8019904

The problem of specifying the extent of the degradation caused by speckle in pictures meant to be examined by a human observer was investigated. A plausible theoretical model was developed for the decision process used by the observer in the detection or discrimination task. This model was used to relate the probability of making a correct decision to the relevant picture parameters such as contrast ratio between the reflectivities of various parts of the picture, number of looks per pixel picture size, and dimension of the features of lines. Calculations for the reasonable SAR parameters of 1 dB contrast ratio and 12 looks per pixel show that, in order to achieve a probability of correct decision of 0.95, (1) a small square in a 100 by 100 pixel background needs to be about 7 pixels on a side; (2) a 100 by 100 pixel grating of line pairs needs to have lines about 2 pixels wide; and (3) a simple geometrical form (a specific one) needs to be at least 12 pixels on a side to be distinguished from another (specific) form of the same size, when these two forms are the only possible alternatives. Dissert. Abstr.

N80-30822 Old Dominion Univ., Norfolk, Va.
THE DEVELOPMENT OF A STEPPED FREQUENCY MICROWAVE RADIOMETER AND ITS APPLICATION TO REMOTE SENSING OF THE EARTH Ph.D. Thesis
Richard Harrington 1980 188 p
Avail: Univ. Microfilms Order No. 8020139

The design, development, application, and capabilities of a variable frequency microwave radiometer are described. This radiometer has demonstrated the versatility, accuracy, and stability required to provide contributions to the geophysical understanding of ocean and ice processes. The design technique utilized a closed loop feedback method, whereby noise pulses were added to the received electromagnetic radiation to achieve a null balance in a Dicke switched radiometer. Stability was achieved through the use of a constant temperature enclosure around the low loss microwave front end. Remote sensing experiments were conducted from an aircraft platform using this radiometer. Four significant scientific observations were accomplished during these experiments. These observations consisted of the first radiometric mapping of an ocean polar front, exploratory experiments to measure the thickness of lake ice, first discrimination between first year and multiyear ice below 10 GHz, and the first known measurements of frequency sensitive characteristics of sea ice. Dissert. Abstr.

N80-30823*# Purdue Univ., Lafayette, Ind. Lab for Applications of Remote Sensing.
[REMOTE SENSING RESEARCH STUDIES] Final Report, 1 Dec. 1978 - 30 Nov. 1979
D. A. Landgrebe Nov. 1979 126 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15466; Proj. AgRISTARS)
(E80-10117; NASA-CR-160551; SR-P9-00414; LARS-120279) Avail: NTIS HC A07/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-30824*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION FOR BOUNDARY DETECTION AND REGISTRATION PROGRAM (BDARP1)
D. P. McKay and F. Collen, Principal Investigators Apr. 1978 124 p ERTS
(Contract NAS9-15200)
(E80-10216; NASA-CR-160651; LEC-12128; JSC-13966) Avail: NTIS HC A06/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-30825*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
FOREST RESOURCE INFORMATION SYSTEM, PHASE 3 Quarterly Report, 1 Jan. - 31 Mar. 1980
R. P. Mroczynski, Principal Investigator, S. Schwingendorf, D. Freeman, C. Kozlowski, C. Smith, and C. Peterson 18 Apr. 1980 121 p Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Contract NAS9-15325)
(E80-10242; NASA-CR-160725; LARS-CR-041880) Avail: NTIS HC A06/MF A01 CSCL 02F

There are no author-identified significant results in this report.

N80-30826*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
DETAILED DESIGN SPECIFICATION FOR THE AUTOMATIC STATUS AND TRACKING SYSTEM MODIFICATIONS FOR LACIE PROCEDURE 1
J. M. Everette, D. L. Smith, and C. C. deValcourt, Principal Investigator May 1977 49 p ERTS
(Contract NAS9-15200)
(E80-10243; NASA-CR-160674; LEC-10529; JSC-12885) Avail: NTIS HC A03/MF A01 CSCL 14B
There are no author-identified significant results in this report.

N80-30827*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
PRELIMINARY USER GUIDE FOR THE PROGRAM GTDDM (GROUND TRUTH DOT DUMP)
C. W. Ahlers, Principal Investigator Jul. 1978 11 p refs ERTS
(Contract NAS9-15200)
(E80-10244; NASA-CR-160715; LEC-12636; JSC-14423) Avail: NTIS HC A02/MF A01 CSCL 09B
There are no author-identified significant results in this report.

N80-30828*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
DESIGN SPECIFICATION FOR COLOR CODED SPECTRAL PLOTS
B. E. Wills, Principal Investigator Sep. 1976 28 p ERTS
(Contract NAS9-12200)
(E80-10245; NASA-CR-160706; LEC-9924; JSC-11851) Avail: NTIS HC A03/MF A01 CSCL 08B
There are no author-identified significant results in this report.

N80-30829*# Florida Univ., Gainesville. Inst. of Food and Agricultural Sciences.
FLORIDA WATER RESOURCES Final Report
Apr. 1980 325 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Contract NAS10-9348)
(E80-10246; NASA-CR-154634; KSC-TR-51-3) Avail: NTIS HC A14/MF A01 CSCL 08H
There are no author-identified significant results in this report.

N80-30830*# Florida Univ., Gainesville. Inst. of Food and Agricultural Sciences.
FLORIDA WATER RESOURCES, EXECUTIVE SUMMARY
Apr. 1980 18 p Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Contract NAS10-9348)
(E80-10247; NASA-CR-154634-Summ; KSC-TR-51-3-Summ) Avail: NTIS HC A02/MF A01 CSCL 08H
There are no author-identified significant results in this report.

N80-30831*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
HIGH DENSITY TAPE REFORMATTING SYSTEM/LANDSAT IMAGERY VERIFICATION AND EXTRACTION SYSTEM (HDTRS/LIVES) THROUGHPUT ANALYSIS
A. J. Bowen, Jr., Principal Investigator Feb. 1980 29 p ERTS
(Contract NAS9-15800)
(E80-10248; NASA-CR-160664; LEMSCO-14548; JSC-16967) Avail: NTIS HC A03/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-30832*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
IMPLEMENTATION SPECIFICATION FOR LARGE AREA CROP INVENTORY EXPERIMENT (LACIE) PHASE 3 AUTOMATIC STATUS AND TRACKING SYSTEM
C. C. deValcourt Mar. 1977 46 p Revised ERTS
(Contract NAS9-15200)
(E80-10249; NASA-CR-160618; LEC-8675-Rev-A; JSC-11401-Rev-A) Avail: NTIS HC A03/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N80-30833*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION FOR SCATTER PLOTS FOR DIRECT WHEAT
O. A. Wehmanen, Principal Investigator Oct. 1978 66 p ERTS
(Contract NAS9-15200)
(E80-10250; NASA-CR-160686; LEC-12822; JSC-14546) Avail: NTIS HC A04/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N80-30834*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
CLASSIFICATION WITH SPECTRAL-SPATIAL-TEMPORAL ARCHETYPES
P. J. Aucoin, Jr. and L. E. Giddings, Principal Investigators Aug. 1978 21 p ERTS
(Contract NAS9-15200)
(E80-10251; NASA-CR-160716; LEC-12691; JSC-14456) Avail: NTIS HC A02/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-30835*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION FOR FIELD STATISTICS (FIELDSTAT)
D. K. McCarley, Principal Investigator Sep. 1978 99 p ERTS
(Contract NAS9-15200)
(E80-10252; NASA-CR-160685; LEC-12804; JSC-14487) Avail: NTIS HC A05/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-30836*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION FOR CLASY PROGRAM MODIFICATION
P. J. Aucoin, Jr. and C. Horton, Principal Investigators Apr. 1978 171 p ERTS
(Contract NAS9-15200)
(E80-10253; NASA-CR-160711; LEC-12185; JSC-13986) Avail: NTIS HC A08/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-30837*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
DETAIL DESIGN SPECIFICATION FOR ENHANCEMENT OF THE AUTOMATIC STATUS AND TRACKING SYSTEM SOFTWARE
D. K. McCarley, Principal Investigator, J. M. Everette, and K. P. Eckel Nov. 1977 102 p ERTS
(Contract NAS9-15200)
(E80-10254; NASA-CR-160634; LEC-11512; JSC-13789) Avail: NTIS HC A06/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-30838*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
DESIGN SPECIFICATION FOR MERGE OF BTREAD, PHASE 1 AND PHASE 2 ACCURACY ASSESSMENT PROGRAMS
A. Rios, Principal Investigator Oct. 1978 11 p ERTS
(Contract NAS9-15200)
(E80-10255; NASA-CR-160718; LEC-12833; JSC-14556) Avail: NTIS HC A02/MF A01 CSCL 09B

There are no author-identified significant results in this report.

N80-30839*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
USER'S GUIDE LARGE AREA CROP INVENTORY EXPERIMENT (LACIE) PHASE 3 PDP 11/45 AUTOMATIC STATUS AND TRACKING SYSTEM
C. C. deValcourt, Principal Investigator Mar. 1977 48 p ERTS
(Contract NAS9-15200)
(E80-10256; NASA-CR-160722; LEC-10148; JSC-12535) Avail: NTIS HC A03/MF A01 CSCL 14B
There are no author-identified significant results in this report.

N80-30840*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
CLASSIFICATION OF MULTISPECTRAL IMAGES ACCORDING TO CROSSWISE TEXTURAL CHARACTERISTICS [CLASSIFICACAO DE IMAGENS MULTIESPECTRAIS, TRAVES DE CARACTERISTICAS DE TEXTURA]
Nelson deJesusParada, Principal Investigator, Enivaldo doOFilho, Nelson D. A. Mascarenhas, and Claudio R. Sonnemburg May 1980 87 p refs In PORTUGUESE; ENGLISH summary Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(E80-10257; NASA-CR-163369; INPE-1734-RPE/134) Avail: NTIS HC A05/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-30841*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
EVALUATING THE REFORESTED AREA FOR THE MUNICIPALITY OF BURI BY AUTOMATIC ANALYSIS OF LANDSAT IMAGERY [AVALIACAO DE AREAS REFLORESTADAS DO MUNICIPIO DE BURI, ATRAVES DE ANALISE AUTOMATICA DE IMAGENS DO LANDSAT]
Nelson deJesusParada, Principal Investigator, David Chung Liang Lee, Redro Hernandez Filho, and Yosio Edemir Shimabukuro Dec. 1979 24 p refs In PORTUGUESE; ENGLISH summary Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(E80-10258; NASA-CR-163365; INPE-1635-RPE/094) Avail: NTIS HC A02/MF A01 CSCL 02F
The author has identified the following significant results. The class of reforestation (Pinus, Eucalyptus, Araucaria) was defined using iterative image analysis (1-100) and LANDSAT MSS data. Estimates of class area by 1-100 were compared with data supplied by the forestry institute in Sao Paulo. LANDSAT channels 4 and 5 served to differentiate the Pinus, Eucalyptus, and Araucaria from the other trees. Channels 6 and 7 gave best results for differentiating between the classes. A good representative spectral response was obtained for Auraucaria on these two channels. The small relative differences obtained were +4.24% for Araucaria, -7.51% for Pinus, and -32.07% for Eucalyptus.

N80-30842*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
STUDY OF THE ATMOSPHERIC EFFECTS ON THE RADIATION DETECTED BY THE SENSOR ABOARD ORBITING PLATFORMS (ERTS/LANDSAT) M.S. Thesis - October 1978 [ESTUDO DOS EFEITOS ATMOSFERICOS SOBRE AS RADIACOES PELOS SENSORES A BORDO DE PLATFORMAS ORBIT AIS (ERTS/LANDSAT)]
Nelson deJesusParada, Principal Investigator and Tsutomu Morimoto Mar. 1980 110 p refs In PORTUGUESE; ENGLISH summary Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57918 ERTS
(E80-10259; NASA-CR-163366; INPE-1689-TDL/021) Avail: NTIS HC A06/MF A01 CSCL 02C
The author has identified the following significant results. Multispectral scanner data for Brasilia were corrected for atmospheric interference using the LOWTRAN-3 computer program and the analytical solution of the radiative transfer equation. This improved the contrast between two natural targets and the corrected images of two different dates were more similar than the original ones. Corrected images of MSS data for Ribeirao Preto gave a classification accuracy for sugar cane about 10% higher as compared to the original images.

N80-30843*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
USE OF LANDSAT DATA FOR ESTIMATING THE AREA OF SUGAR CANE IN THE STATE OF SAO PAULO M.S. Thesis [USO DE DADOS DO LANDSAT PARA AVALIACAO DE AREAS OCUPADAS COM CANA-DE-ACUCAR NO ESTADO DE SAO PAWLO]
Nelson deJesusParada, Principal Investigator and Francisco Jose Mendonca Apr. 1980 83 p refs In PORTUGUESE; ENGLISH summary Sponsored by NASA ERTS
(E80-10260; NASA-CR-163367; INPE-1713-TDL/023) Avail: NTIS HC A05/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N80-30844*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
UTILIZATION OF LANDSAT DATA TO INVENTORY THE SUGAR CANE IN THE STATE OF SAO PAULO [UTILIZACAO DE DADOS DO LANDSAT PARA INVENTARIO DA CANA-DE-ACUCAR DO ESTADO DE SAO PAULO]
Nelson DeJesusParada, Principal Investigator, Francisco Jose Mendonca, David Chung Liang Lee, Yosio Edemir Shimabukuro, Antonio Tebaldi Tardin, Rene Antonio Novaes, and Sherry Chou Che Jan. 1980 18 p refs In PORTUGUESE; ENGLISH summary Sponsored by NASA ERTS
(E80-10261; NASA-CR-163368; INPE-1668-NTE/157) Avail: NTIS HC A02/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N80-30845*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION FOR THE PATTERSON-PITT-THADANI MINIMUM LOSS CLASSIFIER
C. W. Ahlers, Principal Investigator May 1978 56 p ERTS
(Contract NAS9-15200)
(E80-10262; NASA-CR-160712; LEC-12285; JSC-14246) Avail: NTIS HC A04/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-30846*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION FOR PHASE 3 MODEL AREAS ADDED TO THE MONTHLY DATA BASE OF THE US
K. Williams, Principal Investigator Mar. 1977 28 p ERTS
(Contract NAS9-15200)
(E80-10263; NASA-CR-160669; LEC-10354; JSC-12709) Avail: NTIS HC A03/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-30847*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
THE INTEGRATED ANALYSIS PROCEDURE FOR IDENTIFICATION OF SPRING SMALL GRAINS AND BARLEY
R. W. Payne, Principal Investigator May 1980 20 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E80-10274; NASA-CR-160727; FC-L0-451; LEMSCO-14385; JSC-16360) Avail: NTIS HC A02/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N80-30848*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
STATISTICAL OUTLIER DETECTION (SOD): A COMPUTER PROGRAM FOR DETECTING OUTLIERS IN DATA

R. S. Chhikara, C. L. Horton, M. A. Mendlowitz, and A. H. Feiveson, Principal Investigators (NASA, Johnson Space Center) Jun. 1980 25 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E80-10275; NASA-CR-160728; FC-L0-00432; LEMSCO-14594; JSC-16346) Avail: NTIS HC A02/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-30848*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
USER'S GUIDE FOR THE YIELD ESTIMATION SUBSYSTEM DATA MANAGEMENT SYSTEM (YESDAMS)
Roy Davenport and Mike Sestak, Principal Investigators Apr. 1978 51 p ERTS
(Contract NAS9-15200)
(E80-10276; NASA-CR-160710; LEC-12184; JSC-13985) Avail: NTIS HC A04/MF A01 CSCL 05A

There are no author-identified significant results in this report.

N80-30850*# Royal Australian Navy Research Lab., Edgecliff.
HEAT CAPACITY MAPPING MISSION PROJECT HCM-051 Interim Report
C. S. Nilsson, J. C. Andrews, M. W. Lawrence, S. Ball (Weapons Systems Research Lab., Salisbury, Australia), and A. R. Latham, Principal Investigators May 1980 70 p refs Sponsored by NASA *Original contains imagery. Original imagery may be* purchased from NASA Goddard Space Flight Center, (code 601), Greenbelt, Md. 20771. Domestic users send orders to 'Attn: *National Space Science Data Center', nondomestic users send* orders to 'Attn: World Data Center A for Rockets and Satellites'. HCMM
(E80-10278; NASA-CR-163344; Internal-TM-3/80) Avail: NTIS HC A04/MF A01 CSCL 08B

There are no author-identified significant results in this report.

N80-30851*# Pan American Univ., Edinburg, Tex. Dept. of Physical Science.
LIGHT REFLECTANCE, TRANSMITTANCE, AND UTILIZATION WITHIN A VEGETATIVE CANOPY Final Report, 1 Oct. 1978 - 30 Sep. 1979
E. W. LeMaster and J. E. Chance, Principal Investigators Apr. *1980 39 p refs ERTS*
(Grant NsG-9015)
(E80-10282; NASA-CR-163347) Avail: NTIS *HC A03/MF A01 CSCL 20F*

There are no author-identified significant results in this report.

N80-30852*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
OPERATOR'S GUIDE FOR LACIE PHASE 3 AUTOMATIC STATUS AND TRACKING SYSTEM
D. L. Smith, Principal Investigator Mar. 1977 8 p ERTS
(Contract NAS9-15200)
(E80-10284; NASA-CR-160670; JSC-12729) Avail: NTIS *HC A02/MF A01 CSCL 02C*

There are no author-identified significant results in this report.

N80-30853*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
***IMPLEMENTATION SPECIFICATION DOCUMENT FOR* MERGE OF BTREAD, PHASE 1, AND PHASE 2 ACCURACY ASSESSMENT PROGRAMS**
F. Tragni, Principal Investigator May 1978 14 p ERTS
(Contract NAS9-15200)
(E80-10285; NASA-CR-160713; LEC-12348; JSC-14277) *Avail: NTIS HC A02/MF A01 CSCL 09B*

There are no author-identified significant results in this report.

N80-30854*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
DESIGN SPECIFICATION FOR ERIPS FIELDS DATA BASE DECK CONVERSION
C. T. Gardner, Principal Investigator Jun. 1977 18 p ERTS
(Contract NAS9-12200)
(E80-10286; NASA-CR-160667; LEC-10775; JSC-12950) *Avail: NTIS HC A02/MF A01 CSCL 09B*

There are no author-identified significant results in this report.

N80-30855*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
DRAFT USER PROCEDURES: SOFTWARE WHEAT YIELD PREDICTIONS/FOREIGN EQUIVALENT TEST
J. Stewart, Principal Investigator Nov. 1978 32 p ERTS
(Contract NAS9-15200)
(E80-10287; NASA-CR-160687; LEC-12975; JSC-14607) *Avail: NTIS HC A03/MF A01 CSCL 02C*

There are no author-identified significant results in this report.

N80-30856*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
ESTIMATION OF PROBABILITIES OF LABEL IMPERFECTIONS AND CORRECTION OF MISLABELS
C. B. Chittineni, Principal Investigator Mar. 1980 44 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E80-10288; NASA-CR-160704; SR-L0-00427; LEMSCO-14356) Avail: NTIS HC A03/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-30857*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
***AS-BUILT DESIGN SPECIFICATION FOR THE CMAS* IMAGE-100 HYBRID SYSTEM. VOLUME 2: DETAILED FLOW CHARTS AND PROGRAM LISTINGS, PART 1**
L. E. Giddings, Principal Investigator Aug. 1977 395 p ERTS
(Contract NAS9-15200)
(E80-10289; NASA-CR-160709; LEC-10822-Vol-2-Pt-1; *JSC-13030-Vol-2-Pt-1) Avail: NTIS HC A17/MF A01 CSCL* 09B

There are no author-identified significant results in this report.

N80-30858*# *Lockheed Electronics Co., Houston, Tex. Systems* and Services Div.
AS-BUILT DESIGN SPECIFICATION FOR THE CAMS *IMAGE-100 HYBRID SYSTEM. VOLUME 3: UTILITIES* AND SHARED SUBROUTINES
L. E. Giddings, Principal Investigator Aug. 1977 200 p *ref ERTS*
(Contract NAS9-15200)
(E80-10290; NASA-CR-160684; LEC-10822-Vol-3; *JSC-13030-Vol-3) Avail: NTIS HC A09/MF A01 CSCL 05B*

There are no author-identified significant results in this report.

N80-30859*# General Electric Co., Philadelphia, Pa. Space Div.
LANDSAT-2 AND LANDSAT-3 FLIGHT EVALUATION REPORT Technical Report, 23 Jan. - 23 Apr. 1979
1 Jun. 1979 255 p ERTS
(Contract NAS5-21806)
(E80-10291; NASA-CR-159999; Doc-76SDS4227) Avail: *NTIS HC A12/MF A01 CSCL 05B*

There are no author-identified significant results in this report.

N80-30860*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
AGRISTARS CROPPING PRACTICES AND CROP CHARACTERISTICS BASED ON 1979 ESCS OBSERVATIONS
M. A. Wise and D. E. Pitts, Principal Investigators Apr. 1980 448 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development
(Proj. AgRISTARS)

(E80-10292; NASA-TM-81105; SR-JO-00438; JSC-16353) Avail: NTIS HC A19/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-30861*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

A LABELING TECHNOLOGY FOR LANDSAT IMAGERY

T. B. Dennis and M. D. Pore, Principal Investigators May 1980 37 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS

(Contract NAS9-15800; Proj. AgRISTARS)

(E80-10293; NASA-CR-160689; AR-LO-00425; LEMSCO-14357; JSC-16341) Avail: NTIS HC A03/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-30862*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

MAXIMAL ANALYSIS LABELING PROCEDURE (PRELIMINARY)

J. M. Disler, Principal Investigator Feb. 1980 37 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS

(Contract NAS9-15800; Proj. AgRISTARS)

(E80-10294; NASA-CR-160665; FC-LO-00700; JSC-16399) Avail: NTIS HC A03/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-30863*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

AN EXPLORATORY STUDY TO DEVELOP A CLUSTER-BASED AREA ESTIMATION PROCEDURE

R. K. Lennington, Principal Investigator May 1980 102 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS

(Contract NAS9-15800; Proj. AgRISTARS)

(E80-10295; NASA-CR-160729; SR-LO-00442; LEMSCO-14670; JSC-16358) Avail: NTIS HC A06/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-30864*# Environmental Research and Technology, Inc., Concord, Mass.

***INVESTIGATION OF THE APPLICATION OF HCMM* THERMAL DATA TO SNOW HYDROLOGY Progress Report, Apr. - Jun. 1980**

James C. Barnes, Principal Investigator Jul. 1980 7 p Sponsored by NASA HCMM

(E80-10297; NASA-CR-163351) Avail: NTIS HC A02/MF A01 CSCL 08L

The author has identified the following significant results. Comparison of the thermal IR band temperatures over the rapidly melting snowcover in a number of locations in the Salt-Verde Arizona watershed by the U-2 high altitude multispectral scanner, with temperatures for these same locations measured by the corresponding HCMM pass, indicate that the U-2 temperatures are typically 5 C higher than the values analyzed from the HCMM infrared digital printout. Results tend to substantiate findings of other investigators that with the offset that has been applied to all HCMM data, the HCMM temperature values may, in fact, actually be 5 C too low. Analysis of differences between the HCMM day and night temperatures for selected snowcovered areas in the Sierra Nevada Mountains, derived from the daytime and nighttime printouts, show greater delta tau values for the sparsely vegetated higher elevations than for the lower elevation, more densely forested terrain. The differences for the 12 hour sequence are also greater in most instances than the 36 hour difference.

N80-30865*# Stanford Univ., Calif. Dept. of Geology.

SOIL MOISTURE IN RELATION TO GEOLOGIC STRUCTURE AND LITHOLOGY, NORTHERN CALIFORNIA

Ernest I. Rich, Principal Investigator 21 Jul. 1980 2 p HCMM

(Contract NAS5-24479)

(E80-10298; NASA-CR-163352) Avail: NTIS HC A02/MF A01 CSCL 08M

The author has identified the following significant results. Structural features in the Norther California Coast Ranges are clearly discernable on Nite-IR images and some of the structural linears may result in an extension of known faults within the region. The Late Mesozoic marine sedimentary rocks along the western margin of the Sacramento Valley are clearly defined on the Nite-IR images and in a gross way individual layers of sandstone can be differentiated from shale. Late Pleistocene alluvial fans are clearly differentiated from second generation Holocene fans on the basis of tonal characteristics. Although the tonal characteristics change with the seasons, the differentiation of the two sets of fans is still possible.

N80-30866*# Consiglio Nazionale delle Ricerche, Milan (Italy). Inst. per la Geofisica della Litosfera.

STUDY OF GEOLOGICAL STRUCTURE OF SICILY AND OTHER ITALIAN AREAS Progress Report

Roberto Cassinis, Principal Investigator, Giovanni Lachi, Eugenio Zilioli, and Alberto Marini Jun. 1980 6 p Sponsored by NASA HCMM

(E80-10299; NASA-CR-163353; PR-3) Avail: NTIS HC A02/MF A01 CSCL 08B

There are no author-identified significant results in this report.

N80-30867*# Montana Univ., Missoula. Wildlife-Wildlands Inst.

GRIZZLY BEAR HABITAT ANALYSIS. SECTION 3: LANDSAT-1 MULTISPECTRAL IMAGERY AND COMPUTER ANALYSIS OF GRIZZLY BEAR HABITAT

John J. Craighead, Principal Investigator 1980 300 p refs Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

(E80-10300; NASA-CR-163382) Avail: NTIS HC A13/MF A01 CSCL 06C

There are no author-identified significant results in this report.

N80-30868*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

***MAPPING URBANIZED AREA EXPANSION THROUGH* DIGITAL IMAGE PROCESSING OF LANDSAT AND CONVENTIONAL DATA**

Steven Z. Friedman, Principal Investigator 1 Mar. 1980 88 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

(Contract NAS7-100)

(E80-10301; NASA-CR-163355; JPL-Pub-79-113) Avail: NTIS HC A05/MF A01 CSCL 08B

There are no author-identified significant results in this report.

N80-30869*# Kansas State Univ., Manhattan. Evapotranspiration Lab.

USE OF SOIL MOISTURE INFORMATION IN YIELD MODELS

Edward Kanemasu, Arlin Feyerherm, John Hanks, Mel Keener, Dan Lawlor, Phil Rasmussen, Harold Reetz, Keith Saxton, and Craig Wiegand, Principal Investigators Jul. 1980 48 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS

(Contract NAS9-14899; Proj. AgRISTARS)

(E80-10302; NASA-CR-160749; SM-MO-00462) Avail: NTIS HC A03/MF A01 CSCL 08M

There are no author-identified significant results in this report.

N80-30870*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

EVALUATING THE USE OF ANALYST LABELS IN MAXIMUM LIKELIHOOD CLUSTER PROPORTION ESTIMATION

R. K. Lennington and G. R. Terrell, Principal Investigators Apr. 1980 14 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E80-10303; NASA-CR-160754; SR-LO-00456; LEMSCO-14672; JSC-16538) Avail: NTIS HC A02/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-30871*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

EVALUATION OF BAYESIAN SEQUENTIAL PROPORTION ESTIMATION USING ANALYST LABELS

R. K. Lennington and K. M. Abotteen, Principal Investigators May 1980 17 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E80-10304; NASA-CR-160753; SR-LO-00453; LEMSCO-14355; JSC-16361) Avail: NTIS HC A02/MF A01 CSCL 05B

The author has identified the following significant results. A total of ten Large Area Crop Inventory Experiment Phase 3 blind sites and analyst-interpreter labels were used in a study to compare proportional estimates obtained by the Bayes sequential procedure with estimates obtained from simple random sampling and from Procedure 1. The analyst error rate using the Bayes technique was shown to be no greater than that for the simple random sampling. Also, the segment proportion estimates produced using this technique had smaller bias and mean squared errors than the estimates produced using either simple random sampling or Procedure 1.

N80-30872*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.

AS-BUILT DESIGN SPECIFICATION OF THE CAMS/CAS INTERFACE TAPE REPORT GENERATION PROGRAM FOR LACIE 8

K. P. Eckel, Principal Investigator May 1978 131 p ERTS
(Contract NAS9-15200)
(E80-10306; NASA-CR-160750; LEC-12267; JSC-14238) Avail: NTIS HC A07/MF A01 CSCL 09B

There are no author-identified significant results in this report.

N80-30873*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.

AS-BUILT SPECIFICATION FOR CLASSY CONVERSION

P. J. Aucoin, Jr. and C. Horton, Principal Investigators Sep. 1978 261 p ERTS
(Contract NAS9-15200)
(E80-10307; NASA-CR-160751; LEC-12743; JSC-14475) Avail: NTIS HC A12/MF A01 CSCL 09B

There are no author-identified significant results in this report.

N80-30874*# Environmental Research Inst. of Michigan, Ann Arbor.

ANALYSIS OF SCANNER DATA FOR CROP INVENTORIES Progress Report, 15 Nov. 1979 - 15 Feb. 1980

May 1980 97 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15476; Proj. AgRISTARS)
(E80-10308; NASA-CR-160698; ERIM-132400-39-P) Avail: NTIS HC A05/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-30875*# Zentralstelle fuer Geo-Photogrammetrie und Fernerkundung, Munich (West Germany).

APPLICATION EXPLORER MISSION-A HEAT CAPACITY MAPPING MISSION Progress Report

[1980] 19 p Original contains imagery. Original imagery may be purchased from NASA Goddard Space Flight Center, (code 601), Greenbelt, Md. 20771. Domestic users send orders to 'Attn: National Space Science Data Center'; non-domestic users send orders to 'Attn: World Data Center A for Rockets and Satellites'. HCMM
(E80-10309; NASA-CR-163378) Avail: NTIS HC A02/MF A01 CSCL 08B

The author has identified the following significant results. Fine orogenic sediments, not detectable on the images recorded within the visible wavelength region, can be clearly recognized on all night IR-images. The area of glaciation in the northern foreland of the Alps can be partially identified on the basis of night-IR data. The terminal moraine of various glacierization phases can be mapped and the relative dry and unsorted moraine material consisting of crystalline components can be located through the vegetation cover. The eastern part of the glaciation area can be traced because of reverse temperature effect. In addition to the upper Bavarian lakes, the night-IR images clearly indicate the distribution of high soil moisture areas such as swamps and bogs. The geological border of the upper fresh water molasse in the northern part of the basin north of Munich is identifiable on night IR-imagery. Drift peat areas can be located on day-IR images of the dry season of the year.

N80-30876*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE CONTRIBUTION OF THE DIFFUSE LIGHT COMPONENT TO THE TOPOGRAPHIC EFFECT ON REMOTELY SENSED DATA

Chris Justice and Brent Holben Jun. 1980 45 p refs Submitted for publication
(NASA-TM-80728) Avail: NTIS HC A03/MF A01 CSCL 20F

The topographic effect is measured by the difference between the global radiance from inclined surfaces as a function of their orientation relative to the sensor position and light source. The short wave radiant energy incident on a surface is composed of direct sunlight, scattered skylight, and light reflected from surrounding terrain. The latter two components are commonly known as the diffuse component. The contribution of the diffuse light component to the topographic effect was examined and the significance of this diffuse component with respect to two direct radiance models was assessed. Diffuse and global spectral radiances were measured for a series of slopes and aspects of a uniform and surface in the red and photographic infrared parts of the spectrum, using a nadir pointing two channel handheld radiometer. The diffuse light was found to produce a topographic effect which varied from the topographic effect for direct light. The topographic effect caused by diffuse light was found to increase slightly with solar elevation and wavelength for the channels examined. The correlations between data derived from two simple direct radiance simulation models and the field data were not significantly affected when the diffuse component was removed from the radiances. Radiances from a 60 percent reflective surface, assuming no atmospheric path radiance, the diffuse light topographic effect contributed a maximum range of 3 pixel values in simulated LANDSAT data from all aspects with slopes up to 30 degrees. R.K.G.

N80-30877# Wisconsin Univ. - Madison.

MONITORING THE USE OF RIVERWAYS WITH AERIAL PHOTOGRAPHY: THE DEVELOPMENT, TESTING, AND EVALUATION OF A COMPUTER ASSISTED METHODOLOGY Final Report

R. H. Becker, William A. Gates, and Bernard J. Niemann, Jr. 31 Mar. 1980 363 p
(Contract DACW25-79-C-0008)
(AD-A086471) Avail: NTIS HC A16/MF A01 CSCL 14/5

The objectives of this investigation were to develop, test and evaluate a recreational monitoring methodology using aerial photography and computer assisted data capture with auxiliary equipment. To meet these objectives, photography was flown, interpretation techniques were developed and utilized, hardware was assembled, software was written and recreational monitoring results were obtained. Section 1, includes a statement of objectives, how the report is organized, a summary of available photography, a brief summary of methods employed, and some conclusions. Section 2, Pool 16 Users Results, includes the results obtained from applying the methodology for six flights over Pool 16. It also includes discussion of the results and provides graphic

examples of results. Section 3, Evaluation of the Methodology, includes equipment and personnel requirements, the time utilized developing and testing the methodology, and the costs incurred. The reliability of the methodology, error control and error discovery are discussed. Section 4, Aerial Photographic Methods, includes a detailed discussion of the methods and equipment employed to purchase, obtain and process the aerial photography for the riverway. Section 5, Interpretative methods, discusses the methods employed to interpret, locate and encode targets from the photography. Section 6, Handbook/Codebook, includes a detailed description of each variable encoded as part of the methodology. It also includes the rules used to interpret each of the target types. GRA

N80-30878# Earth Science Consulting and Technology Corp., Costa Mesa, Calif.

MULTI-SOURCE IMAGE ANALYSIS Final Report

David D. Steller, Michael R. Mel, Debra J. Shiroma, William Muir, and Julie A. Sowma Dec. 1979 157 p refs

(Contract DAAK70-78-C-0180)

(AD-A086332; ETL-0208) Avail: NTIS HC A08/MF A01 CSCL 08/6

For the purposes of this study, multi-source image analysis is defined as the utilization of imagery from panchromatic photography, radar and thermal infrared systems for providing military geographic information. The imagery was limited to sets available from a variety of governmental and commercial sources. Effort was made to obtain images from all three sensor systems, but at some test sites only one or two types were utilized. Sensor characteristics were evaluated in relationship to the targets of interest and sensor keys determined. Several useful enhancement techniques were utilized to emphasize feature parameters. Comparison interpretation using all three image types provided valuable complementary target information. GRA

N80-30879# Army Cold Regions Research and Engineering Lab., Hanover, N. H.

RADIO-ECHO SOUNDING IN THE ALLAN HILLS, ANTARCTICA, IN SUPPORT OF THE METEORITE FIELD PROGRAM Special Report

Austin Kovacs May 1980 12 p refs

(Grant NSF DPP-77-19565)

(AD-A086858; CRREL-SR-80-23) Avail: NTIS HC A02/MF A01 CSCL 08/12

Radio-echo sounding measurements made on Ross Island and in the Allan Hills Antarctica indicate that radio-echo sounding may offer the unique possibility of detecting a buried meteorite in glacial ice. The results also revealed internal layering within the snow on Ross Island and in the snow filling an ice depression west of Allan Nunatak. Radio-echo sounding also gave the depth to bedrock near the west side of Allan Nunatak. The greatest ice depth measured was 310 m. GRA

N80-30880# LeSchack Associates Ltd., Silver Spring, Md.

CORRELATION OF UNDER-ICE ROUGHNESS WITH SATELLITE AND AIRBORNE THERMAL INFRARED DATA

Leonard A. LeSchack May 1980 46 p refs

(Contract N00014-76-C-0757)

(AD-A085512; TR-2) Avail: NTIS HC A03/MF A01 CSCL 08/12

This report, based on empirical data, concludes that a correlation has been found between easily obtainable sea ice surface temperature and under-ice roughness data which are obtainable only at great expense. Under-ice roughness is valuable in evaluating acoustic attenuation beneath the Arctic ice and is expressed in terms of either root-mean-square (RMS) ice depth or standard deviation about the mean ice depth, both of which are closely correlated. By showing a functional relationship between the skewness of the surface temperature distribution as derived from NOAA VHRR Satellite thermal infrared data and the under-ice roughness, the way appears clear to make a chart of Arctic under-ice roughness for Arctic acoustic programs and for nuclear submariners. In a second study, under ice data recorded in April 1976 by the SSN GURNARD was correlated with the skewness of temperature distributions derived from NOAA VHRR IR data recorded in March 1976 over nominally the same area of the Beaufort Sea. A third study was then conducted that shows, perhaps more graphically than the others, the correlation of under-ice data recorded by the British nuclear submarine HMS SOVEREIGN between 18-21 October 1976 with airborne IR data recorded during the same period over the submarine track by a Canadian Forces Argus aircraft. In all three examples, when the RMS ice depth range was between 4 and 8 m, corresponding to a standard deviation of ice depth ranging between 2 and 6 m, there is a strong, negative linear correlation between the skewness of the temperature distributions, whether measured from satellites or aircraft, and the under-ice roughness measured by submarine upward-looking sonar. GRA

N80-30881# Edgerton, Germeshausen and Grier, Inc., Sunnyvale, Calif.

AERIAL GAMMA RAY AND MAGNETIC SURVEY: RATON BASIN PROJECT. THE RATON AND SANTA FE QUADRANGLES OF NEW MEXICO Final Report

Dec. 1979 324 p refs

(Contract EY-76-C-13-1664)

(GJBX-9(80)-Vol-2) Avail: NTIS HC A14/MF A01

The Santa Fe quadrangle in central New Mexico lies principally within the Southern Rocky Mountains and Great Plains Provinces. The west is dominated by the Sangre de Cristo Mountains. The eastern and southern regions contain portions of the Sierra Grande Arch and the Las Vegas and Tucumcari Basins. These structures primarily contain permian, triassic, cretaceous, and tertiary sediments. Many areas of the quadrangle are covered by cretaceous through quaternary igneous rocks of a variety of types. Magnetic data reflect both deep and shallow sources. The basins show as regions of low frequency/low amplitude wavelengths except where significant amounts of igneous rocks are exposed. The Santa Fe quadrangle has been unproductive in terms of uranium. All known uranium occurrences to date have proven uneconomic. Two goups of anomalies in the Sangre de Cristo Mountains appear to be most significant in terms of their peak count rates. DOE

N80-30882# Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.

REMOTE SENSING OF WILDLAND RESOURCES: A STATE-OF-THE-ART REVIEW Forest Service Final General Technical Report

Robert C. Aldrich Dec. 1979 62 p refs

(PB80-184609; FSGTR-RM-71) Avail: NTIS HC A04/MF A01 CSCL 14E

A review, with literature citations, of current remote sensing technology, applications, and costs for wildland resource management, including collection, interpretation, and processing of data gathered through photographic and nonphotographic techniques for classification and mapping, interpretative information for specific applications, measurement of resource parameters, and observations and counts of occurrences is presented. GRA

N80-30883# North Carolina State Univ. at Raleigh.

PROBABILITY SAMPLING TO MEASURE POLLUTION FROM RURAL LAND RUNOFF Final Report, Jul. 1974 - Dec. 1978

F. J. Humenik, D. W. Hayne, M. R. Overcash, J. W. Gilliam, and A. M. Witherspoon Feb. 1980 215 p refs

(Grant EPA-R-803328)

(PB80-175946; EPA-600/3-80-035) Avail: NTIS HC A10/MF A01 CSCL 08H

The feasibility of probability sampling in describing quality of rural water not affected by point sources is examined. The study site was a portion of the Chowan River Basin in Virginia and North Carolina. Flow was measured along with dissolved oxygen, temperature, conductivity, and pH. All samples were analyzed for nitrate plus nitrite nitrogen, total Kjeldahl nitrogen, total phosphate, and chloride. Flow was highly variable in time and space; concentration was less so. GRA

N80-30884# National Technical Information Service, Springfield, Va.

REMOTE SENSING OF THE OCEAN: PHYSICAL, CHEMICAL, AND GEOLOGIC PROPERTIES. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1976 - May 1980

Robena J. Brown Jun. 1980 123 p Supersedes NTIS/PS-79/0585; NTIS/PS-78/0563 Updates COM-73-11676

(PB80-811235; NTIS/PS-79/0585; NTIS/PS-78/0563; COM-73-11676) Avail: NTIS HC $30.00/MF $30.00 CSCL 08J

Remote sensing methods as they are applied to ocean temperature, sea ice, marine biology, and sound and light transmission are included. Techniques of measurement using radiometry, microwave spectroscopy, radar systems, infrared spectroscopy, and photography are described. These measurements are made from both aircraft and satellites. This updated bibliography contains 116 abstracts, 17 of which are new entries to the previous edition. GRA

N80-30885# National Technical Information Service, Springfield, Va.
REMOTE SENSING OF THE OCEAN: DYNAMICS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1970 - May 1980
Roberta J. Brown 1980 191 p Supersedes NTIS/PS-79/0586; NTIS/PS-78/0564 Updates COM-73-11676
(PB80-811243; NTIS/PS-79/0586; NTIS/PS-78/0564; COM-73-11676) Avail: NTIS HC $30.00/MF $30.00 CSCL 08J

Remote sensing methods as they are applied to ocean currents, wind sediment transport, ocean waves, sea states, and air water interactions are included. The various techniques of measurement using radiometers, lasers, radar, and microwave and infrared equipment are described. This updated bibliography contains 183 abstracts, 18 of which are new entries to the previous edition. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N80-30886 Drexel Univ., Philadelphia, Pa.
INDUSTRIAL APPLICATION AND ASSESSMENT OF WASTE ENERGY RECOVERY TECHNOLOGIES Ph.D. Thesis
Michael John Koluch 1980 319 p
Avail: Univ. Microfilms Order No. 8019349

Nine generic waste energy recovery technologies were examined for potential applications in industry. These were heat exchangers, Rankine power cycles, Brayton power cycles, Stirling power cycles, heat pumps, absorption cooling systems, expanders, burner, and cogeneration systems. Several industries were examined. A methodology was developed to assess waste energy recovery technologies. It comprises an industry waste flow/technology compatibility prescreen computer model, prescreen evaluation, specific technology application computer model and technology application assessment. Technology limitations were incorporated into a computer model to prescreen potential applications in 87 industrial processes. Results of that prescreen indicated that heat exchangers, heat pumps, Rankine cycles and cogeneration systems ranked highest in the utilization of waste streams. Numerous specific waste stream, technology, end use applications were examined in detail. Performance technology models were used to simulate applications. M.G.

N80-30887 Vanderbilt Univ., Nashville, Tenn.
SOLAR THERMAL ENERGY STORAGE USING A PARAFFIN WAX PHASE CHANGE MATERIAL Ph.D. Thesis
Arthur Bart Shapiro 1980 134 p
Avail: Univ. Microfilms Order No. 8018904

A shell tube thermal energy storage (TES) unit is proposed with the shell side containing a paraffin wax. The physical system is mathematically modelled by the two dimensional transient heat conduction equation in cylindrical coordinates. This equation is solved by an explict finite difference algorithm. A numerical marching method is used in the z direction to preserve the three dimensional nature of the physical system. The numerical solution uses temperature dependent thermodynamic and transport properties. Values for the density thermal conductivity, and enthalpy for the solid and liquid phase were determined by experimental methods and extrapolation of published property data. Results from a parametric study are presented in graphs of percent storage capacity versus time and tube side fluid temperature drop versus time. The parameters varied were tube side fluid mass flow rate, tube length, tube diameter, and tube spacing. The results present valuables insight into operational trends and acceptable operating ranges of the TES unit. A design example using these results is presented. Dissert. Abstr.

N80-30888*# General Electric Co., Fairfield, Conn. Energy Technology Operation.
COGENERATION TECHNOLOGY ALTERNATIVES STUDY (CTAS). VOLUME 6: COMPUTER DATA. PART 1: COAL-FIRED NOCOGENERATION PROCESS BOILER, SECTION A Final Report
W. F. Knightly May 1980 469 p
(Contract DEN3-31)
(NASA-CR-159770-Pt-1-A; DOE/NASA/0031-80/6-Vol-6-Pt-1A; GE80ET0105-Vol-6-Pt-1A) Avail: NTIS HC A20/MF A01 CSCL 10B

About fifty industrial processes from the largest energy consuming sectors were used as a basis for matching a similar number of energy conversion systems that are considered as candidate which can be made available by the 1985 to 2000 time period. The sectors considered included food, textiles, lumber, paper, chemicals, petroleum, glass, and primary metals. The energy conversion systems included steam and gas turbines, diesels, thermionics, stirling, closed cycle and steam injected gas turbines, and fuel cells. Fuels considered were coal, both coal and petroleum based residual and distillate liquid fuels, and low Btu gas obtained through the on site gasification of coal. Computer generated reports of the fuels consumption and savings, capital costs, economics and emissions of the cogeneration energy conversion systems (ECS's) heat and power matched to the individual industrial processes are presented. National fuel and emissions savings are also reported for each ECS assuming it alone is implemented. Two nocogeneration base cases are included: coal fired and residual fired process boilers. T.M.

N80-30889*# General Electric Co., Fairfield, Conn. Energy Technology Operation.
COGENERATION TECHNOLOGY ALTERNATIVES STUDY (CTAS). VOLUME 6: COMPUTER DATA. PART 1: COAL-FIRED NOCOGENERATION PROCESS BOILER, SECTION B Final Report
W. F. Knightly May 1980 480 p
(Contract DEN3-31)
(NASA-CR-159770-Pt-1-B; DOE/NASA/0031-80/6-Vol-6-Pt-1B; GE80ET0105-Vol-6-Pt-1B) Avail: NTIS HC A21/MF A01 CSCL 10B

About fifty industrial processes from the largest energy consuming sectors were used as a basis for matching a similar number of energy conversion systems that are considered as candidate which can be made available by the 1985 to 2000 time period. The sectors considered included food, textiles, lumber, paper, chemicals, petroleum, glass, and primary metals. The energy conversion systems included steam and gas turbines, diesels, thermionics, stirling, closed cycle and steam injected gas turbines, and fuel cells. Fuels considered were coal, both coal and petroleum based residual and distillate liquid fuels, and low Btu gas obtained through the on site gasification of coal. Computer generated reports of the fuel consumption and savings, capital costs, economics and emissions of the cogeneration energy conversion systems (ECS's) heat and power matched to the individual industrial processes are presented. National fuel and emissions savings are also reported for each ECS assuming it alone is implemented. Two nocogeneration base cases are included: coal fired and residual fired process boilers. T.M.

N80-30890*# General Electric Co., Fairfield, Conn. Energy Technology Operation.
COGENERATION TECHNOLOGY ALTERNATIVES STUDY

(CTAS). VOLUME 6: COMPUTER DATA. PART 2: RESIDUAL-FIRED NOCOGENERATION PROCESS BOILER Final Report
W. F. Knightly May 1980 296 p
(Contract DEN3-31)
(NASA-CR-159770-Pt-2; DOE/NASA/0031-80/6-Vol-6-Pt-2; GE80ET0105-Vol-6-Pt-2) Avail: NTIS HC A13/MF A01 CSCL 10B

About fifty industrial processes from the largest energy consuming sectors were used as a basis for matching a similar number of energy conversion systems that are considered as candidate which can be made available by the 1985 to 2000 time period. The sectors considered included food, textiles, lumber, paper, chemicals, petroleum, glass, and primary metals. The energy conversion systems included steam and gas turbines, diesels, thermionics, stirling, closed cycle and steam injected gas turbines, and fuel cells. Fuels considered were coal, both coal and petroleum based residual and distillate liquid fuels, and low Btu gas obtained through the on site gasification of coal. Computer generated reports of the fuel consumption and savings, capital costs, economics and emissions of the cogeneration energy conversion systems (ECS's) heat and power matched to the individual industrial processes are presented. National fuel and emissions savings are also reported for each ECS assuming it alone is implemented. Two nocogeneration base cases are included: coal fired and residual fired process boilers. T.M.

N80-30891*# Rice Univ., Houston, Tex.
SOLAR POWER SATELLITE OFFSHORE RECTENNA STUDY Final Report
May 1980 284 p refs Prepared in cooperation with Brown and Root Development, Inc., Houston, Tex. and Little (Arthur D.), Inc., Cambridge, Mass.
(Contract NAS8-33023)
(NASA-CR-161543) Avail: NTIS HC A13/MF A01 CSCL 10A

Offshore rectennas are feasible and cost competitive with land rectennas but the type of rectenna suitable for offshore use is quite different from that specified in the present reference system. A nonground plane design minimizes the weight and greatly reduces the number of costly support towers. This perferred design is an antenna array consisting of individually encapsulated dipoles with reflectors or tagis supported on feed wires. Such a 5 GW rectenna could be built at a 50 m water depth site to withstand hurricane, winter storm, and icing conditions for a one time cost of $5.7 billion. Subsequent units would be about 1.3 less expensive. More benign and more shallow water sites would result in substantially lower costs. The major advantage of an offshore rectenna is the removal of microwave radiation from populated areas. L.F.M.

N80-30892*# International Business Machines Corp., Huntsville, Ala. Federal Systems Div.
SOLAR ENERGY SYSTEM PERFORMANCE EVALUATION REPORT FOR SOLARON-DUFFIELD, DUFFIELD, VIRGINIA Seasonal Report, Oct. 1979 - Mar. 1980
Jul. 1980 80 p refs Prepared for DOE
(Contract NAS8-32036)
(NASA-CR-161507) Avail: NTIS HC A05/MF A01 CSCL 10A

The Solaron Duffield Solar Energy System was designed to provide 51 percent of the space heating, and 49 percent of the domestic hot water (DHW) to a two story 1940 square foot area residence using air as the transport medium. The system consists of a 429 square foot collector array, a 265 cubic foot rock thermal storage bin, heat exchangers, an 80 gallon DHW preheat tank, pumps, blowers, controls, air ducting and associated plumbing. A air-to-liquid heat pump coupled with a 1,000 gallon water storage tank provides for auxiliary space heating and can also be used for space cooling. A 52 gallon electric DHW tank using the solar preheated water provides domestic hot water to the residence. The solar system, which became operational July 1979, has the following modes of operation: First Stage: (1) collector to storage and DHW; (2) collector to space heating; (3) storage to load. Second Stage: (4) heat pump auxiliary direct; (5) auxiliary heat from heat pump storage. Third Stage: (6) electrical resistance (strip) heat. Author

N80-30893*# IBM Federal Systems Div., Huntsville, Ala. Federal Systems Div.
SOLAR ENERGY SYSTEM PERFORMANCE EVALUATION REPORT FOR IBM SYSTEM 4 AT CLINTON, MISSISSIPPI Seasonal Report, Oct. 1978 - Mar. 1980
Jul. 1980 91 p refs Prepared for DOE
(Contract NAS8-32036)
(NASA-CR-161509) Avail: NTIS HC A05/MF A01 CSCL 10A

The IBM System 4 Solar Energy System is described and evaluated. The system was designed to provide 35 percent of the space heating and 63 percent of the domestic hot water preheating for a single family residence located within the United States. The system consists of 259 square feet of flat plate air collectors, a rock thermal storage containing 5 1/2 ton of rock, heat exchangers, blowers, a 52 gallon preheat tank, controls, and associated plumbing. In general, the performance of the system did not meet design expectations, since the overall design solar fraction was 48 percent and the measured value was 32 percent. Although the measured space heating solar fraction at 32 percent did agree favorably with the design space heating solar fraction at 35 percent, the hot water measured solar fraction at 33 percent did not agree favorably with the design hot water solar fraction of 63 percent. In particular collector array air leakage, dust covered collectors, abnormal hot water demand, and the preheat tank by pass valve problem are main reasons for the lower performance. M.G.

N80-30894*# IBM Federal Systems Div., Huntsville, Ala. Federal Systems Div.
SOLAR ENERGY SYSTEM ECONOMIC EVALUATION FINAL REPORT FOR SEMCO-LOXAHATCHEE, LOXAHATCHEE NATIONAL WILDLIFE REFUGE, PALM BEACH COUNTY, FLORIDA Final Report
Jul. 1980 98 p refs Prepared for DOE
(Contract NAS8-32036)
(NASA-CR-161512) Avail: NTIS HC A05/MF A01 CSCL 10A

Economic analysis of the solar energy system installed at Loxahatchee, was developed for Loxahatchee and four other sites typical of a wide range of environmental and economic conditions in the continental United States. This analysis was accomplished based on the technical and economic models in the f Chart design procedure with inputs based on the characteristics of the installed system and local conditions. The results are expressed in terms of the economic parameters of present worth of system costs over a projected twenty year life, life cycle savings, year of positive savings and year of payback for the optimized solar energy system at each of the analysis sites. The sensitivity of the economic evaluation to uncertainties in constituent system and economic variables was also investigated. The results demonstrate that the solar energy system is economically viable at all of the five sites for which the analysis was conducted. T.M.

N80-30895*# City of Kansas City, Mo.
SOLAR HEATING AND DOMESTIC HOT WATER SYSTEM INSTALLED AT KANSAS CITY, FIRE STATIONS, KANSAS CITY, MISSOURI Final Report
Jul. 1980 170 p Sponsored by NASA
(Contract EX-76-C-01-2373)
(NASA-CR-161513) Avail: NTIS HC A12/MF A01 CSCL 10A

The solar system was designed to provide 47 percent of the space heating, 8,800 square feet area and 75 percent of the domestic hot water (DHW) load. The solar system consists of 2,808 square feet of Solaron, model 2001, air, flat plate collector subsystem, a concrete box storage subsystem which contains 1,428 cubic feet of 0.5 inch diameter pebbles weighing 71.5 tons, a DHW preheat tank, blowers, pumps, heat exchangers, air ducting, controls and associated plumbing. Two 120 gallon electric DHW heaters supply domestic hot water which is preheated by the solar system. Auxiliary space heating is provided by three electric heat pumps with electric resistance heaters and four 30 kilowatt electric unit heaters. There are six modes of system operation. R.K.G.

N80-30896*# IBM Federal Systems Div., Huntsville, Ala. Federal Systems Div.
SOLAR ENERGY SYSTEM PERFORMANCE EVALUATION REPORT FOR IBM SYSTEM 3, GLENDO, WYOMING Seasonal Report, Jan. - Dec. 1979
Jun. 1980 85 p refs Prepared for DOE
(Contract NAS8-32036)
(NASA-CR-161520) Avail: NTIS HC A05/MF A01 CSCL 10A

The analysis used was based on instrumented system data monitored and collected for at least one full season of operation. The long-term field performance of the installed system is described. Technical contributions to the definition of techniques and requirements for solar energy system design are given. T.M.

N80-30897*# Raytheon Co., Waltham, Mass. Microwave and Power Tube Div.
SATELLITE POWER SYSTEM (SPS) MAGNETRON TUBE ASSESSMENT STUDY Final Performance Review
12 Aug. 1980 99 p refs
(Contract NAS8-33157)
(NASA-CR-161547; MA03) Avail: NTIS HC A05/MF A01 CSCL 10A

Taks performed to extend the data base and to define a technology development program for the magnetron directional amplifier for the SPS are reviewed. These include: (1) demonstrating the tracking of phase and amplitude of the microwave output to phase and amplitude references; (2) expanding the range of power over which the directional amplifier will operate; (3) recognizing the importance of amplitude control in overall system design and in simplifying power conditioning; (4) developing a preliminary design for the overall architecture of the power module; (5) demonstrating magnetron starting using the amplitude control system; (6) mathematically modelling and performing a computerized study of the pyrolytic graphite radiating fin; (7) defining the mass of the magnetic circuit for the SPS tube; (8) noise measurement; (9) achieving harmonic suppression by notch reflection filters; (10) estimating the mass of the transmitting antenna; (11) developing a magnetron package with power generation, phase control, and power condition functions; and (12) projecting magnetron package characteristics. A.R.H.

N80-30898*# ECON, Inc., Princeton, N. J.
SPS SALVAGE AND DISPOSAL ALTERNATIVES Final Report
30 Jun. 1980 90 p refs
(Contract NAS8-33783)
(NASA-CR-161548; Rept-80-1489) Avail: NTIS HC A05/MF A01 CSCL 10A

A wide range of salvage options exist for the satellite power system (SPS) satellite, ranging from use in and beyond geo-synchronous orbit to use in low Earth orbit to return and use on Earth. The satellite might be used intact to provide for various purposes, it might be cannibalized, or it might be melted down to supply materials for space- or ground-based products. The use of SPS beyond its nominal lifetime provides value that can be deducted from the SPS capital investment cost. It is shown that the present value of the salvage value of the SPS satellites, referenced to the system initial operation data, is likely to be on the order of five to ten percent of its on-orbit capital cost. (Given a 30 year satellite lifetime and a four percent discount rate, the theoretical maximum salvage value is 30.8 percent of the initial capital cost). The SPS demonstration satellite is available some 30 years earlier than the first full-scale SPS satellite and has a likely salvage value on the order of 80 percent of its on site capital cost. In the event that it becomes desirable to dispose of either the demomstration or full-scale SPS satellite, a number of disposal options appear to exist for which intact disposal costs are less than one percent of capital costs. L.F.M.

N80-30899*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala. Electronic and Control Lab.
SOLAR SITE TEST MODULE
Ralph R. Kissel and Donald R. Scott Jul. 1980 32 p Sponsored in part by DOE
(NASA-TM-78291) Avail: NTIS HC A03/MF A01 CSCL 10A

A solar site test module using the Rockwell AIM 65 microcomputer is described. The module is designed to work at any site where an IBM site data acquisition system (SDAS) is installed and is intended primarily as a troubleshooting tool. It collects sensor information (temperatures, flow rates, etc.) and displays or prints it immediately in calibrated engineering units. It will read one sensor on demand, periodically read up to 10 sensors or periodically read all sensors. Performance calculations can also be included with sensor data. Unattended operation is possible to, e.g., monitor a group of sensors once per hour. Work is underway to add a data acquisition system to the test module so that it can be used at sites which have no SDAS. Author

N80-30900*# Rockwell International Corp., Downey, Calif.
SATELLITE POWER SYSTEMS (SPS) CONCEPT DEFINITION STUDY. VOLUME 7: SYSTEM/SUBSYSTEM REQUIREMENTS DATA BOOK Final Report
G. M. Hanley Sep. 1980 120 p
(Contract NAS8-32475)
(NASA-CR-3324; SSD-79-0010-7-Vol-7) Avail: NTIS HC A06/MF A01 CSCL 10A

The identified subsystem/systems requirements are defined for the solar power satellites. Recommendations for alternate approaches which may represent improved design features are presented. T.M.

N80-30901*# Rockwell International Corp., Downey, Calif.
SATELLITE POWER SYSTEMS (SPS) CONCEPT DEFINITION STUDY. VOLUME 1: EXECUTIVE SUMMARY Final Report
G. M. Hanley Washington NASA Sep. 1980 67 p refs 7 Vol.
(Contract NAS8-32475)
(NASA-CR-3317; SSD-79-0010-1-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 10A

System definition studies resulted in a further definition of the reference system using gallium arsenide solar arrays, analysis of alternative subsystem options for the reference concept, preliminary solid state microwave concept studies, and an environmental analysis of laser transmission systems. The special emphasis studies concentrated on satellite construction, satellite construction base definition, satellite construction base construction, and rectenna construction. Major emphasis in the transportation studies was put on definition of a two stage parallel burn, vertical takeoff/horizontal landing concept. The electric orbit transfer vehicle was defined in greater detail. Program definition included cost analyses and schedule definition. T.M.

N80-30902# Prototech, Inc., Newton Highlands, Mass.
ENERGY SAVINGS BY MEANS OF FUEL CELL ELECTRODES IN ELECTRO-CHEMICAL INDUSTRIES Annual Report, 1 Aug. 1978 - 31 Jul. 1979
Robert J. Allen, Walter Juda, Robert W. Lindstrom, and Henry G. Petrow 31 Oct. 1980 200 p refs
(Contract ET-78-C-02-4881)
(COO-4881-12) Avail: NTIS HC A10/MF A01

Energy and cost savings in electrowinning of zinc by substituting, for the conventional lead anode, a Prototech proprietary hydrogen anode operating on pure and impure feeds were evaluated experimentally along with voltage, and thus energy savings in chloralkali membrane cells by substituting, for the conventional steel cathode, a Prototech proprietary air cathode. Suitable air electrodes for metal/water/air batteries were considered. Cost estimates of all processes investigated based on laboratory results were prepared. DOE

N80-30903# Pacific Missile Test Center, Point Mugu, Calif.
PACIFIC MISSILE TEST CENTER ENERGY PROJECTS. SUMMARY OF PROJECTS, CONTRIBUTIONS, AND PLANS
Jay Rosenthal and Craig Savant Jan. 1980 53 p refs
(AD-A086196; PMTC-TP-80-14) Avail: NTIS HC A04/MF A01 CSCL 13/2

This report is a compilation of the projects undertaken at the Pacific Missile Test Center to conserve energy, develop and apply alternative energy sources, and develop, in the 1980s,

basic capability (BACADE) projects for applying energy-saving technology to the needs of the Pacific Missile Test Center. GRA

N80-30904# IIT Research Inst., Chicago, Ill.
NAVY-NEW HAMPSHIRE WIND ENERGY PROGRAM Final Report, 4 Jun. - 31 Oct. 1979
S. A. Bortz, R. A. Budenholzer, R. D. Carlson, I. Fieldhouse, and J. Kornfeld Nov. 1979 264 p refs Supersedes IITRI-D6169
(Contract N00014-79-C-6503)
(AD-A086506; IITRI-M6052; IITRI-D6169) Avail: NTIS HC A12/MF A01 CSCL 10/2

This program investigated the potential of the Mt. Washington, New Hampshire area for generating electric power from wind energy as an alternative to fossil fuels. The U.S. Naval Shipyard at Portsmouth, New Hampshire is among those facilities which could benefit initially from successful wind generated power. IIT Research Institute (IITRI) specialists performed the following tasks: (1) Evaluation of New Hampshire's wind energy resources for potential electric power generation using meteorological, topographical, biological and other available information, (2) Assessment of the environmental, social, technical, and other possible barriers to the development of wind energy resources, and (3) Economic evaluation of installing one or more wind turbine generators to supply power either directly to the Shipyard or to lines of the Public Service Company of New Hampshire which supplies the Shipyard. GRA

N80-30905# Energy Research Corp., Danbury, Conn.
AQUEOUS TRIFLUOROMETHANESULFONIC ACID FUEL CELLS Interim Technical Report, Jun. 1978 - Aug. 1979
Michael George Dec. 1979 47 p refs
(Contract DAAK70-78-C-0103)
(AD-A086579; ERC-6154-I) Avail: NTIS HC A03/MF A01 CSCL 10/2

Subscale hydrogen-air fuel cells were successfully operated with 6M TFMSA as the electrolyte at temperatures as high as 60 C. The fuel cell performance was enhanced over similarly loaded electrodes in H3PO4 due to the apparent improved kinetics for the oxygen reduction reaction. A variety of unsupported and supported Pt electrocatalysts could be effectively utilized. TFMSA fuel cells could be operated stably for periods as long as 3000 hours if water balance was maintained. Activity coefficients calculated by the van Laar equations were utilized to predict water partial pressures of dilute TFMSA solutions. GRA

N80-30906# Duracell International, Inc., Burlington, Mass. Lab. for Physical Science.
LITHIUM-THIONYL CHLORIDE BATTERY Quarterly Report, 1 Nov. 1979 - 31 Jan. 1980
A. N. Dey, N. Hamilton, W. Bowden, P. Witalis, and D. Cubbison Jun. 1980 61 p refs
(Contract DAAB07-78-C-0563; DA Proj. 1L1-62705-AH-94)
(AD-A085661; DELET-TR-78-0563-5; QR-5) Avail: NTIS HC A04/MF A01 CSCL 10/3

The Li/SOCl2 inorganic electrolyte system is the highest energy density system known to date. It consists of an Li anode, a carbon cathode and SOCl2, which acts both as a solvent and cathode active material. The electrolyte salt that has been used most extensively is LiAlCl4, but salts such as Li2B10Cl10 and Li2O(AlCl3)2 have also been used successfully in this system for improving the shelf life characteristics. The main objective of this program is to develop high rate Li/SOCl2 cells and batteries for portable applications of the U.S. Army. The cells and batteries must deliver higher energy densities than are presently available and must be safe to handle under field conditions. GRA

N80-30907# Rockwell International Corp., Golden, Colo. Energy Systems Group.
ROCKY FLATS SMALL WIND SYSTEMS TEST CENTER ACTIVITIES. VOLUME 1: ATMOSPHERIC TEST DATA COLLECTED FROM SMALL WIND ENERGY CONVERSION SYSTEMS Interim Report, 1 Jul. 1978 - 30 Jun. 1979
Jul. 1979 122 p 2 Vol.
(Contracts EY-76-C-04-3533; DE-AC04-76DP-03533)
(RFP-3004-Vol-1; IR-2-Vol-1) Avail: NTIS HC A06/MF A01

The wind system data of various tests of small wind energy conversion system (SWECS) are presented. Much of the data are not final, but are believed to present an accurate representation of the performance of each system. Because of operating problems and failures experienced by some of the machines (and at times by the data collection system) the amount of data available for analysis varies widely from system to system. Data are presented on a total of 16 machines, including updated data on nine machines which were presented in the first semiannual report. Vibration, controlled velocity testing and plans for a dynamometer test facility (which is under construction) are described. The description of each system under test includes information on design output, output type, rotor configuration, and other basic design features. The condition under which each SWECS was tested are described. Graphic plots of quantitative data and narrative accounts of qualitative data collected on each SWECS are provided. DOE

N80-30908# Rockwell International Corp., Golden, Colo. Energy Systems Group.
ROCKY FLATS SMALL WIND SYSTEMS TEST CENTER ACTIVITIES. VOLUME 2: CONTROLLED VELOCITY, VIBRATION AND DYNAMOMETER TESTING OF SMALL WIND ENERGY CONVERSION SYSTEMS Interim Report
Jul. 1979 44 p 2 Vol.
(Contracts EY-76-C-04-3533; DE-AC04-76DP-03533)
(RFP-3004-Vol-2; IR-2-Vol-2) Avail: NTIS HC A03/MF A01

Controlled velocity, vibration, and dynamometer testing performed on small wind energy conversion systems are discussed. Results of controlled velocity testing on wind machines and of vibration testing of five wind machines are included. DOE

N80-30909# Physical Sciences, Inc., Woburn, Mass.
COAL PROCESSING FOR FUEL CELL UTILIZATION. TASK 11: FLUIDIZED BED COAL GASIFICATION MODEL: DATA ANALYSIS AND PREDICTIONS
Michael L. Finson Jan. 1980 69 p refs
(Contract EW-78-A-21-8450)
(METC-8450-T1; TR-209) Avail: NTIS HC A04/MF A01

Development and application of a computational model for fluidized bed gasification of coal is described. A two phase bubbling bed reactor model accounts for the development of bubbles, clouds, and emulsion, with a new statistical treatment to predict bubble size. Coal char reactivity is described in detail, using models for carbon heterogeneous chemistry, pore structure, and mass transport previously developed. Volatile release is handled in a semiempirical manner, and potential gas phase reactions between fuel and oxygen in the bubbles are allowed. The data imply larger gas by passing and particle carry over than predicted, and the computed performance exceeds that observed. The computer program was exercised to map out gasifier performance over a range of conditions. It is shown that proper fluidization often requires more gas flow than can be accommodated chemically, due to limited kinetics and mass transport. DOE

N80-30910# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SOLAR PHOTOVOLTAIC MODULE DEGRADATION FROM ELECTRO-MIGRATION
C. F. Hornig, E. S. Wainwright, S. E. Forman, M. S. Hsu, and M. P. Themelis 15 Apr. 1980 27 p refs
(Contract EY-76-C-02-4094)
(COO-4094-64) Avail: NTIS HC A03/MF A01

The effects of outdoor weathering on both encapsulated and unencapsulated solar photovoltaic modules are discussed. Degradation modes that result from exposure in a terrestrial environment and which influence long term module performance are identified. Two modules, stripped of their protective RTV coating, and a third encapsulated module were placed in the open circuit mode and monitored for five months. The encapsulated module showed no evidence of degradation during the five months of this investigation. The unencapsulated modules showed signs of both physical and electrical degradation. Auger analysis of these unencapsulated cells disclosed the migration of Sn between positive and negative surfaces on the same cell and the migration of Sn from the cell's negative grid (when this negative grid is adjacent to a cell row at lower potential or the metal module edge). This migrating Sn, combined with the SiOx antireflective film, altered the coating structure and appearance. Both degradation modes depend on the presence of moisture, and will thus reduce module peak power by 8 to 11 percent. DOE

N80-30911# Sandia Labs., Albuquerque, N. Mex.
UTILITY VIEWS ON SOLAR THERMAL CENTRAL RECEIVERS
M. J. Fish Apr. 1980 67 p refs
(Contract EY-76-C-04-0789)
(SAND-80-8203) Avail: NTIS HC A04/MF A01

The concerns of a number of US utilities about the solar thermal central receiver concepts are reported. The discussions forced on identifying technical demonstrations and government incentives necessary for commercializing the technology. The implications for a commercialization plan are discussed. DOE

N80-30912# Rockwell International Corp., Anaheim, Calif. Electronic Devices Div.
THIN FILMS OF InP FOR PHOTOVOLTAIC ENERGY CONVERSION Quarterly Technical Progress Report, 29 Sep. - 28 Dec. 1979
Harold M. Manasevit, R. P. Ruth, L. A. Moudy, J. J. J. Yang, and R. E. Johnson Jan. 1980 45 p refs
(Contract DE-AC02-79ET-23004)
(COO-3004-2; QTPR-2) Avail: NTIS HC A03/MF A01

Growth parameters are established using triethylindium, diethylzinc (DEZn), and PH3 sources for the formation of Zn doped p type InP films. The properties of grains and grain boundaries in polycrystalline InP films are investigated using several polycrystalline film/substrate combinations, including tungsten (W) layers produced by roller coating and screen printing on polycrystalline alumina, and mechanically abraded surfaces of single crystal bulk InP:Fe wafers. The use of GaP as an alternative intermediate layer material to GaAs on low cost substrates for subsequent growth of InP films is also examined. Auger electron spectroscopy analysis done on a group of specially prepared Zn treated films of polycrystalline InP indicates the presence of Zn at surfaces of InP:Zn films grown on Al and/or heat treated in high concentrations of DEZn at 600 C. However, no Zn is detected in polycrystalline films grown under deposition conditions that would be expected to produce highly doped p type epitaxial films if single crystal substrates were used. DOE

N80-30913# Los Alamos Scientific Lab., N. Mex.
PERFORMANCE ESTIMATES FOR ATTACHED SUNSPACE PASSIVE SOLAR HEATED BUILDINGS
Robert D. McFarland and Robert W. Jones (South Dakota Univ., Vermillion) 1980 6 p refs Presented at 1980 Ann. Meeting of Am. Sect. of Intern. Solar Energy Soc. Conf., Phoenix, Ariz., 2-6 Jun. 1980
(Contract W-7405-eng-36)
(LA-UR-80-853; CONF-800604-4) Avail: NTIS HC A02/MF A01

Performance predictions are made for attached Sun space types of passively solar heated buildings. The predictions are based on hour by hour computer models developed in the framework of PASOLE, the passive solar energy simulation program. The models have been validated by detailed comparison with actual hourly temperature measurements taken in attached sunspace test rooms. DOE

N80-30914# Argonne National Lab., Ill. Integrated Assessments and Policy Evaluations Group.
CLIMATE AND ENERGY: A COMPARATIVE ASSESSMENT OF THE SATELLITE POWER SYSTEM (SPS) AND ALTERNATIVE ENERGY TECHNOLOGIES
David A. Kellermeyer Jan. 1980 69 p refs
(Contract W-31-109-eng-38)
(DOE/ER-0050) Avail: NTIS HC A04/MF A01

The potential effects of five energy technologies on global, regional, and local climate are assessed. The energy technologies examined are coal combustion, light water nuclear reactors, satellite power systems, terrestrial photovoltaics, and fusion. The assessment focuses on waste heat rejection, production of particulate aerosols, and emission of carbon dioxide. The current state of climate modeling and long range climate prediction introduces considerable uncertainty into the assessment, but it may be concluded that waste heat will not produce detectable changes in global climate until world energy use increases 100 fold, although minor effects on local weather may occur now; that carbon dioxide from coal combustion in the US alone accounts for about 30% of the current increase in global atmospheric CO2 which may, by about 2050 increase world temperature 2 to 3 C, with pronounced effects on world climate; and that rocket exhaust from numerous launches during construction of a satellite power system may affect the upper atmosphere, with uncertain consequences. DOE

N80-30915# Argonne National Lab., Ill. Integrated Assessments and Policy Evaluations Group.
COMPARATIVE ASSESSMENT OF ENVIRONMENTAL WELFARE ISSUES ASSOCIATED WITH THE SATELLITE POWER SYSTEM (SPS) AND ALTERNATIVE TECHNOLOGIES
E. P. Levine, M. J. Senew, and R. R. Cirillo Apr. 1980 99 p refs
(Contract W-31-109-eng-38)
(DOE/ER-0055) Avail: NTIS HC A05/MF A01

Environmental deterioration and associated welfare effects from two mature electric power generation systems (combustion of coal and light water nuclear reactors) are compared with those expected from a conceptual satellite power system. Each activity within the energy pathway for each power system is examined to determine the potential welfare effects it imposes on a community. The severities of these effects are compared. On the basis of this comparison and the state of knowledge concerning specific environmental impacts and welfare effects, key environmental issues are identified for subsequent, in-depth analyses. DOE

N80-30916# Argonne National Lab., Ill. Energy and Environmental Systems Div.
COMPARATIVE ANALYSIS OF NET ENERGY BALANCE FOR SATELLITE POWER SYSTEMS (SPS) AND OTHER ENERGY SYSTEMS
R. R. Cirillo, B. S. Cho, M. R. Monarch, and E. P. Levine Apr. 1980 143 p refs
(Contract W-31-109-eng-38)
(DOE/ER-0056) Avail: NTIS HC A07/MF A01

The net energy balance of seven electric energy systems is assessed: two coal-based, one nuclear, two terrestrial solar, and two solar power satellites, with principal emphasis on the latter two systems. Solar energy systems require much less operating energy per unit of electrical output. However, on the basis of the analysis used here, coal and nuclear systems are two to five times more efficient at extracting useful energy from the primary resource base than are the solar energy systems. The payback period for all systems is less than 1.5 years, except for the terrestrial photovoltaic (19.8 yr) and the solar power satellite system (6.4 yr), both of which rely on energy-intensive silicon cells. DOE

N80-30917# Hittman Associates, Inc., Columbia, Md.
USE OF ORGANIC WORKING FLUIDS IN RANKINE ENGINES
H. M. Curran Sep. 1979 23 p refs
(Contract DE-AC03-79CS-00202)
(DOE/CS-30202/T1) Avail: NTIS HC A02/MF A01

A compilation is presented of state-of-the-art data on the use of organic working fluids in operational Rankine cycle engines. Particular attention is given to the determination of the maximum temperatures used for various working fluids in operational Rankine cycle engines and identification of thermal instability and chemical reaction problems related to these temperatures. Information is included on the characteristics and selection of working fluids; the behavior of lubricating oils in contact with working fluids; operational experience; and recommended organic fluids R and D. DOE

N80-30918# Ueland and Junker, Architects and Planners, Philadelphia, Pa.
SOLAR ATRIUM: A HYBRID SOLAR HEATING AND COOLING SYSTEM Technical Progress Report, 19 Mar. - 19 Jun. 1979
Mark Ueland 28 Jun. 1979 10 p
(Grant EG-77-G-04-4135)
(DOE/CS-34135/T1; TPR-7) Avail: NTIS HC A02/MF A01

Construction progress of the test model residence in which 'solar atrium' is to be installed is listed. Photographs of the 'solar atrium' are included. R.K.G.

N80-30919# Brookhaven National Lab., Upton, N. Y. Dept. of Energy and Environment.
HYBRID PHOTOVOLTAIC/THERMAL SYSTEMS WITH A SOLAR-ASSISTED HEAT PUMP
Edward A. Kush 1980 7 p refs Presented at the Am. Sect./Intern. Solar Energy Soc. 1980 Ann. Meeting Phoenix, Ariz., 2-6 Jun. 1980
(Contracts EY-76-C-02-0016; DE-AC02-76CH-00016)
(BNL-27667) Avail: NTIS HC A02/MF A01

An outline of possibilities for effective use of photovoltaic/thermal (PV/T) collectors with a Solar Assisted Heat Pump is given. A quantitative analysis of the performance and cost of the various configurations as a function of regional climates, using up-to-date results from solar heat pump and PV/T collector studies, will be required for more definitive assessment; and it is recommended that these be undertaken in the PV/T Program. Particular attention should be paid to development of high performance PV/T collectors, matching of heat pump electrical system to PV array and power conditioning characteristics, and optimization of storage options for cost effectiveness and utility impact. DOE

N80-30920# Battelle Pacific Northwest Labs., Richland, Wash.
SUPPLEMENTARY MATERIAL ON PASSIVE SOLAR HEATING CONCEPTS: A COMPILATION OF PUBLISHED ARTICLES. PRESENTED IN CONJUNCTION WITH A SERIES OF PASSIVE SOLAR HEATING SEMINARS SPONSORED BY THE SOLAR ENERGY TECHNOLOGY TRANSFER PROGRAM
May 1979 99 p
(Contract EY-76-C-06-1830)
(PNL-SA-7820) Avail: NTIS HC A05/MF A01

A compilation of published articles and reports dealing with passive solar energy concepts for heating and cooling buildings is presented. The following are included: fundamentals of passive systems, applications and technical analysis, graphic tools, and information sources. DOE

N80-30921# Pennsylvania State Univ., University Park. Materials Research Lab.
CONTROLLED CADMIUM TELLURIDE THIN FILMS FOR SOLAR CELL APPLICATIONS (EMERGING MATERIALS SYSTEMS FOR SOLAR CELL APPLICATIONS) Quarterly Progress Report, 9 Oct. 1979 - 9 Jan. 1980
K. Vedam, M. B. Das, and S. V. Krishnaswamy Feb. 1980 28 p refs
(Contract DE-AC04-79ET-23013)
(DOE/ET-23023/T3; QPR-3) Avail: NTIS HC A03/MF A01

Emphasis during the third quarter of the program was on the improvement of the quality of sputtered films, their characterization and use in the fabrication of Schottky barrier type diodes and solar cell structures. Films prepared under different conditions and on different substrates were examined showing modular growths under certain conditions. I-V, C-V, and photovoltaic characteristics were measured on numerous samples based on n- and p-type films on Ni substrates having top metallization of either evaporated Au and Al. The n-type samples showed up to 200 mV V/sub oc/and small short-circuit currents. The characteristics observed are indicative of the presence of interfacial layer and surface states. Surface state's capacitance were measured on p-type samples metalized with Au. DOE

N80-30922# Department of Energy, Washington, D. C. Div. of Central Solar Technology.
REPORT OF THE 6TH OCEAN THERMAL ENERGY CONVERSION CONFERENCE. OCEAN THERMAL ENERGY FOR THE 1980'S
Gordon L. Dugger, ed. 1979 543 p refs Conf. held in Washington, D.C., 19 Jun. 1979 Prepared in cooperation with the Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
(CONF-790631-1) Avail: NTIS HC A23/MF A01

For the United States, four ocean energy technologies offer significant promises: Ocean Thermal Energy Conversion (OTEC) (using heated surface waters), wave power, ocean currents, and salinity gradients. An overview of the DOE program for these four technologies is presented in terms of plans, concept descriptions, projected market penetration, and potential institutional barriers to implementation. The OTEC program presently receives about 95% of the total ocean energy systems funds. Up to 2 Quads (2 x 1,000,000,000,000,000 Btu/yr fuel equivalent or approximately 22 GW(e) of average OTEC power output) is practically achievable by the year 2000, dependent only on the commercialization strategy employed after the demonstration plant. DOE

N80-30923# Sandia Labs., Albuquerque, N. Mex. Photovoltaic Projects Div.
PHOTOVOLTAIC SYSTEMS AND APPLICATIONS PERSPECTIVE
Gary J. Jones 1980 8 p refs Presented at the Am. Sect. of the Intern. Solar Energy Soc. Conf., Phoenix, Ariz., 2 Jun. 1980
(Contract EY-76-C-04-0789)
(SAND-80-0926C; CONF-800604-14) Avail: NTIS HC A02/MF A01

The National Photovoltaic Program is currently in the process of increasing emphasis on full scale system experiments in the potential user environment. At this point large amounts of design information are available and need to be brought together in usable form to support this effort. The state of understanding in the system definition area for the major applications is reviewed, and the remaining issues, especially as they impact the field test activities, are indicated. DOE

N80-30924# Rocket Research Corp., Redmond, Wash.
SULFURIC ACID AND WATER CHEMICAL HEAT PUMP/CHEMICAL ENERGY STORAGE PROGRAM, PHASE 2-A Final Report
E. C. Clark 1979 132 p refs
(Contract EY-76-C-04-0789)
(SAND-78-8176; RRC-79-R-727) Avail: NTIS HC A07/MF A01

A solar charged chemical heat pump/chemical energy storage (solar/CHP/CES) device is described with the ability to utilize solar energy for heat pumping, space cooling, and extended duration thermal energy storage. A study of solar/CHP/CES system economics, system optimization and component testing, and assessment of the ability to commercialize the system is presented. DOE

N80-30925# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
DEVELOPMENT OF SOLAR DRIVEN ABSORPTION AIR CONDITIONERS AND HEAT PUMPS
K. Dao, M. Wahlig, E. Wali, J. Rasson, and E. Molishever Mar. 1980 3 p refs Presented at the DOE Active Solar Heating and Cooling Contractors Rev. Meeting, Lake Tahoe, Nev., 26 Mar. 1980
(Contract W-7405-eng-48)
(LBL-10771; CONF-800340-6) Avail: NTIS HC A02/MF A01

The development of absorption refrigeration systems for solar active heating and cooling applications is discussed. The approaches investigated are those using air-cooled condenser-absorber and those leading to coefficient of performances (COP) that increase continuously with heat source temperature. This is primarily an experimental project, with the emphasis on designing, fabricating and testing absorption chillers in operating regimes that are particularly suited for solar energy applications. It is demonstrated that the conventional single-effect ammonia-water absorption cycle can be used (with minor modifications) for solar cooling. DOE

N80-30926# Brookhaven National Lab., Upton, N. Y. Dept. of Energy and Environment.
SOLAR ASSISTED HEAT PUMP PROGRAM OVERVIEW AND SUMMARY OF WORK AT BROOKHAVEN NATIONAL LABORATORY
John W. Andrews 1980 6 p refs Presented at the Ann. DOE Active Solar Heating and Cooling Contractors Rev. Meeting, Incline, Nev., 26-28 Mar. 1980
(Contract EY-76-C-02-0016)
(BNL-27662) Avail: NTIS HC A02/MF A01

Four generic paths for avoiding the high utility power demand for solar assisted heat pump systems when the Sun is not shining and storage is depleted are described. These include the bimodal solar assisted heat pump system, direct expansion solar

collector/heat pump systems, volume dominated ground coupled systems, and area dominated ground coupled systems. Work on heat pump development, ground coupling, and low cost collectors for use with these systems is reviewed. DOE

N80-30927# Argonne National Lab., Ill. Chemical Engineering Div.

DEVELOPMENT OF ADVANCED BATTERIES AT ARGONNE NATIONAL LABORATORY Summary Report, 1979

Apr. 1980 45 p

(Contract W-31-109-eng-38)

(ANL-80-32) Avail: NTIS HC A03/MF A01

The batteries being developed are for electric vehicle propulsion and stationary energy storage applications. The principal cells under investigation at present are of a vertically oriented, prismatic design with one or more inner positive electrodes of FeS or FeS2 facing negative electrodes of Li-Al alloy, and molten LiCl-KCl electrolyte; the cell operating temperature is 400 to 500 C. A small effort on the development of a calcium/metal sulfide cell is also being conducted. A 40 kWh electric vehicle battery was fabricated and delivered for testing. During heat-up, one of the modules failed due to a short circuit. A failure analysis was conducted and the Mark IA program completed. Development work on the next electric vehicle battery (Mark 11) was initiated. Work on stationary energy storage batteries consisted primarily of conceptual design studies. DOE

N80-30928# Lincoln Lab., Mass. Inst. of Tech., Lexington.

SYSTEM DESIGN, TESTS RESULTS, AND ECONOMIC ANALYSIS OF A FLYWHEEL ENERGY STORAGE AND CONVERSION SYSTEM FOR PHOTOVOLTAIC APPLICATIONS

A. R. Millner and T. Dinwoodie 1980 7 p Presented at the 14th Photovoltaics Specialists Conf., San Diego, Calif., 7 Jan. 1980 Prepared in cooperation with MIT, Cambridge, Mass.

(Contract EY-76-C-02-4094)

(COO-4094-70; CONF-800106-18) Avail: NTIS HC A02/MF A01

The development of a flywheel interface and storage system for use with photovoltaic power sources is discussed. Test data on the performance of components built to investigate the feasibility of such a system, and the results of economic studies of the system showing user-worth analysis and manufacturing-cost estimates, are presented. The system has magnetic bearings, a maximum-power-point tracker, dc input, and cycloconverter output from an ironless-armature motor-generator. DOE

N80-30929# Ames Lab., Iowa. Dept. of Chemical Engineering.

PROCESSES TO INCREASE UTILIZATION OF POWER SOLID WASTES

M. J. Murtha and G. Burnet 1979 18 p refs Presented at the ASCE Power Res. Council/Elect. Power Res. Inst. Workshop, San Diego, Calif., 23 Apr. 1979

(Contract W-7405-eng-82)

(ISM-245; CONF-790499-3) Avail: NTIS HC A02/MF A01

Two processes are being developed for extracting metals from fly ash, limestone, and soda ash is sintered and the alumina extracted from the clinker using a dilute sodium carbonate solution. Recoveries of over 90% are obtained from both bituminous and subbituminous coal ashes, and the calcium silicate residue can be used as a raw material for cement. The second metals recovery method involves high temperature chlorination of the ash in the presence of a reductant in an equilibrium fixed bed or fluidized bed reactor. Several metals are recovered as chlorides. Ash feed preparation for both processes includes magnetic separation of an iron-rich fraction which shows promise as a heavy media material or an iron ore. It is expected that at least one of the processes will work on other coal wastes such as fluidized bed combustion residue, coal gasification and liquefaction wastes, and limestone scrubber sludge. DOE

N80-30930# Westinghouse Electric Corp., East Pittsburgh, Pa. Advanced Systems Technology Dept.

DESIGN STUDY AND ECONOMIC ASSESSMENT OF MULTI-UNIT OFFSHORE WIND ENERGY CONVERSION SYSTEMS APPLICATION. VOLUME 1: EXECUTIVE SUMMARY Final Report

L. A. Kilar 14 Jun. 1979 59 p

(Contract EX-76-C-01-2330)

(WASH-2330-78/4-Vol-1) Avail: NTIS HC A04/MF A01

Offshore wind energy conversion system design, both deep and shallow water, are evaluated. The costs of building offshore platforms and underwater cables for power transmission are discussed. Maps show the U.S. ocean areas most suitable for optimum results. L.F.M.

N80-30931# Rockwell International Corp., Golden, Colo. Rocky Flats Plant.

SENCENBAUGH: MODEL 1000-14 WIND TURBINE GENERATOR Performance Report

K. K. Higashi Jul. 1979 13 p

(Contract DE-AC04-76DP-03533)

(RFP-3034/3533/79-5) Avail: NTIS HC A02/MF A01

Data are provided which give an accurate picture of the performance of the Sencenbaugh Model 1000-14 under conditions approximating normal use. Every effort was made to ensure that the data provided are accurate and the calibration of all instruments was continuously maintained. The tests were designed to develop a power curve for a known load (application) and determine the ability of the machine to survive high winds (85 mph or greater). The Sencenbaugh was tested under a variety of tail assembly adjustment modes. In none of the tests did the test data match the manufacturer's performance curve; however, changing the tail orientation resulted in proved performance. The model tested is no longer in production, and was replaced by a model with a redesigned tail assembly. L.F.M.

N80-30932# General Electric Co., St. Petersburg, Fla.

NEW PROCESSING FOR DEB POWDER FOR THERMAL BATTERIES

R. Szwarc and R. D. Walton Jun. 1980 9 p refs Presented at the 29th Power Sources Conf., Atlantic City, 9 Jun. 1980

(Contract EY-76-C-04-0656)

(GEPP-OP-486; CONF-800612-4) Avail: NTIS HC A02/MF A01

The electrochemical batteries employed are primary reserve batteries which employ a pelletized cell design. Each cell consists of an electrolyte-depolarizer pellet sandwiched between an anode and a heat pellet. The depolarizer-electrolyte, commonly referred to as DEB, is composed of $CaCrO_4$, LiClKCl eutectic and SiO_2 binder powder, which has been blended and pressed into pellets. The DEB pellet serves as electrolyte and as active cathode when the salt becomes molten upon battery activation. The heat pellet serves the dual purpose of providing the heat necessary to activate the battery and as the cathode current collector. The heat pellet is composed of iron powder and $KClO_4$. Since activated life requirements for batteries vary from seconds up to one hour, the battery must be well insulated to conserve the heat produced by the ignition of the heat pellets to maintain the electrolyte in a molten state and to protect sensitive electronic components in contact with the battery case. Because the electrolyte, particularly LiCl, is hygroscopic, the batteries are hermetically sealed in stainless steel cans, and are manufactured in dryrooms maintained at 3% relative humidity or better. DOE

N80-30933# Sandia Labs., Albuquerque, N. Mex.

PERFORMANCE DATA FOR A LITHIUM-SILICON/IRON DISULFIDE, LONG-LIFE, PRIMARY THERMAL BATTERY

Rod K. Quinn, Arlen R. Baldwin, and James R. Armito 1980 18 p refs Presented at the 24th Power Sources Conf., Atlantic City, 9 Jun. 1980

(Contract EY-76-C-04-0789)

(SAND-79-2148C; CONF-800612-3) Avail: NTIS HC A03/MF A01

The effects of various environmental tests on battery performance are reported. In order to simulate possible nuclear ordnance environments, batteries were subjected to shock, rhythmic and random vibration, and longitudinal and lateral acceleration in the unactivated and activated state. The level and duration of these tests varied, but the performance remained good. The effects of variation in current density from open circuit to 1 A/sq cm as well as various pulse loads were examined. Also presented are results of stabilizing the batteries at temperatures in the range of -54 C to +70 C as reflected in

various performance parameters. The Li(Si)/LiCl.KCl/FeS2 electrochemical system was also applied to two new Sandia designed batteries requiring rugged, medium life performance, i.e., activated lives of 2.5 and 4 minutes. Encouraging initial results of this application are included here. DOE

N80-30934# TRW Energy Systems, Redondo Beach, Calif.
FEASIBILITY STUDY FOR INDUSTRIAL COGENERATION FUEL CELL APPLICATION
15 Nov. 1979 67 p refs
(Contract ET-78-C-03-1889)
(SAN-1889-T1) Avail: NTIS HC A04/MF A01

A study of the feasibility of using a first generation, phosphoric acid fuel cell as a cogenerating, total energy system for aluminum processing is presented. The objectives of the study were to: (1) determine the technical, institutional, and economic factors which would make the first generation fuel cell attractive; (2) identify modifications of fuel cell technology which would enhance fuel cell attractiveness in an industrial climate; and (3) define institutional and economic changes which might enhance fuel cell attractiveness. The study incorporated a number of tasks, involving site selection, thermal and electrical load characterization, definition of fuel cell fuel supply options, evaluation of environmental impacts, and consideration of ownership options. DOE

N80-30935# Mound Lab., Miamisburg, Ohio.
POWER INDEPENDENT IGNITION ENERGY MEASUREMENTS
J. Mohler 1980 11 p ref Presented at the 7th Intern. Pyrotechnics Seminar, Vail, Colo., 14 Jul. 1980
(Contract DE-AC04-76DP-00005)
(MLM-2709(OP); CONF-800713-7) Avail: NTIS HC A02/MF A01

A procedure for establishing the minimum, power independent ignition energy is described. Integration of the power pulse from start until ignition yields the ignition energy. Repetition of this procedure at different power levels permits one to plot energy versus firing time. Since conduction losses are time dependent, extrapolation of the resulting curve to zero time yields an ignition energy value that is independent of losses due to thermal conduction. A key to the success of the procedure is accurate observation of ignition time. It was found that the reaction energy released at ignition causes a discernible deflection in the firing current record. By comparison of light emission and current traces, it was found that the onset of deflagration occurs at the inflection point of the current trace deflection. This procedure has been successfully applied to hot pressed thermite samples, yielding ignition energies that are in qualitative agreement with the expected sensitivities of the samples. DOE

N80-30938# Brookhaven National Lab., Upton, N. Y.
COMPARATIVE ASSESSMENT OF FIVE LONG-RUN ENERGY PROJECTIONS
Andy S. Kydes and John D. Pearson Dec. 1979 134 p refs
(Contract DE-AC02-76CH-00016)
(DOE/EIA/CR-0016/02) Avail: NTIS HC A07/MF A01

Five long term forecasts of energy projection are compared under similar assumptions. These include: (1) PILOT Process integrated Model/Welfare Equilibrium Model system (PILOT or PPIM/WEM); (2) ETA-MACRO energy economy model system; (3) the combined Brookhaven National Laboratory (DNL/DJA) energy model system; (4) the FOSSIL2 (1978) energy model; and (5) the Long range Energy Analysis Package energy model ARC-78. The method of preparation of each forecast is summarized and the differences are explained both in terms of data assumption and methodological approach. R.K.G.

N80-30937# Brookhaven National Lab., Upton, N. Y. Electrochemical Technology Group.
FUEL CELLS FOR ELECTRIC UTILITY AND TRANSPORTATION APPLICATIONS
S. Srinivasan 1980 30 p refs Presented at the Seminar on Electrochem. Systems: Batteries and Fuel Cells, Fortaleza-Ceara, Brazil, 2 Mar. 1980
(Contract EY-76-C-02-0016)
(BNL-27452; CONF-800324-2) Avail: NTIS HC A03/MF A01

The status of fuel cell development is reviewed. For terrestrial electric utility applications, the most promising are phosphoric acid, molten carbonate and solid electrolyte fuel cells. The first will be coupled with a reformer (to convert natural gas, petroleum derived and biomass fuels to hydrogen) while the second and third with a coal gasifier. As ground transportation power sources, the promising systems are phosphoric (or alternate acid) and alkaline electrolyte fuel cells. In the first case, methanol is most attractive while in the second, it will be hydrogen stored as a compressed gas or as a hydride. A technoeconomic assessment of a 'Regenerative Hydrogen-Halogen Energy Storage System' demonstrates the prospects of its use for load leveling when coupled with nuclear, solar or wind power plants. DOE

N80-30938# Oak Ridge National Lab., Tenn. Energy Div.
THERMALLY DRIVEN OPEN-CYCLE HEAT PUMP SYSTEM
F. C. Chen 1980 9 p refs Presented at the 11th Ann. Modeling and Simulation Conf., Pittsburgh, 1 May 1980
(Contract W-7405-eng-26)
(CONF-800549-1) Avail: NTIS HC A02/MF A01

The technical feasibility of a thermally driven open cycle heat pump is analyzed through the design simulation. It is intended to utilize waste heat from Federal nuclear facilities via temperature augmentation for process steam production. Based on the simulation analysis, the design of the open cycle heat pump to supply 4535 kg/hour 10,000 lb/hour, 121 C process steam is within the state-of-the-art. Its energy savings and cost estimate as compared to a baseline case and the alternatives are also presented. DOE

N80-30939# Brobeck (William M.) and Associates, Berkeley, Calif.
CONTROL SYSTEM CONSIDERATIONS FOR AN ALUMINUM-AIR BATTERY POWERED ELECTRIC VEHICLE Final Report
Laurence E. Cox, Gregory V. Hassman, and Stephen F. Post 15 May 1980 35 p
(Contract W-7405-eng-48)
(UCRL-15241; Rept-4500-95-23-R1A) Avail: NTIS HC A03/MF A01

Basic motor controller requirements and tradeoffs between 30 cell and 60 cell aluminum air battery systems were established. A sample controller design was evolved and basic characteristics were evaluated. Advantages of a 60 cell battery system over a 30 cell were found in the areas of control system costs, weights, and efficiency. DOE

N80-30940# United Technologies Corp., South Windsor, Conn. Power Systems Div.
CONCEPTUAL DESIGN OF ELECTRICAL BALANCE OF PLANT FOR ADVANCED BATTERY ENERGY STORAGE FACILITY Annual Report, Mar. 1979
Joseph R. Vivinito and Frederick J. Kornbrust Jan. 1980 137 p
Prepared for Argonne National Lab., Ill.
(Contract W-31-109-eng-38)
(ANL-80-16; FCR-1367) Avail: NTIS HC A07/MF A01

The development of advanced batteries for utility energy storage systems is discussed. Realization of the full benefits available from those systems requires development, not only of the batteries themselves but also the ac/dc power converter, the bulk power interconnecting equipment, and the peripheral electric balance of plant equipment that integrate the battery/converter into a properly controlled and protected energy system. These overall system aspects are addressed for a 20 MW, 100 MWh lithium/sulfide battery system. DOE

N80-30941# Battelle Pacific Northwest Labs., Richland, Wash.
SITING HANDBOOK FOR SMALL WIND ENERGY CONVERSION SYSTEMS
Harry L. Wegley, James V. Ramsdell, Montie M. Orgill, and Ron L. Drake Mar. 1980 90 p refs
(Contracts EY-76-C-06-1830; DE-AC06-76RL-01830)
(PNL-2521-Rev-1) Avail: NTIS HC A05/MF A01

A siting guide for small wind energy conversion systems having a rated capacity of less than 100 kilowatts is presented. Meteorological, geographical, and wind data collection considerations are discussed. By properly using the siting techniques, an owner can select a site that will yield the most power at the

least installation cost, the least maintenance cost, and the least risk of damage or accidental injury. DOE

N80-30942# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
ENERGY ANALYSIS PROGRAM, FY 1979
Apr. 1980 78 p refs
(Contract W-7405-eng-48)
(LBL-10320) Avail: NTIS HC A05/MF A01

Energy analysis attempts to understand the volitional choices of energy use and supply available to human society, and the multi-faceted consequences of choosing any one of them. Topics deal with economic impacts; assessments of regional issues and impacts; air quality evaluation; institutional and political issues in California power plant siting; assessment of environmental standards; water issues; characterization of aquatic systems dissolved oxygen profiles; modeling; computer-generated interactive graphics; energy assessment in Hawaii; solar energy in communities; utilities solar financial data; population impacts of geothermal development; energy conservation in colleges and residential sectors; energy policy; decision making; building energy performance standards; standards for residential appliances; and impact of energy performance standards on demand for peak electrical energy. DOE

N80-30943# Rockwell International Corp., Golden, Colo. Energy Systems Group.
SMALL WIND TURBINE SYSTEMS 1979: A WORKSHOP ON R AND D REQUIREMENTS AND UTILITY INTERFACE/ INSTITUTIONAL ISSUES. VOLUME 1: R AND D REQUIREMENTS
Darrell M. Dage, ed. and Joel V. Stafford, ed. 1979 299 p refs Conf. held at Boulder, Colo., 27 Feb. - 1 Mar. 1979
(Contract EY-76-C-04-3533)
(RFP-3014-Vol-1) Avail: NTIS HC A13/MF A01

Current wind turbine design efforts to reduce the cost of energy to a minimum, and still provide a safe and reliable turbine system are discussed. The major thrust of any supporting research and technology development program should be directed toward this same goal. The factors which contribute to the cost of energy, and which can possibly be improved by research and development are analyzed. DOE

N80-30944# Auburn Univ., Ala. Water Resources Research Inst.
EXPERIMENTAL STUDY OF THE STORAGE OF THERMAL ENERGY IN CONFINED AQUIFERS Final Report, 1 Jul. 1977 - 31 Dec. 1979
F. J. Molz, A. David Parr, and Peter F. Andersen May 1980 51 p refs
(Contract W-7405-eng-26)
(ORNL/Sub-7338/1) Avail: NTIS HC A04/MF A01

A two cycle experiment was performed in which heated water was stored in a confined aquifer and then recovered. During the first cycle, 54,784 cubic meters of water were pumped from a shallow supply aquifer, heated to an average temperature of 55 C, and injected into a deeper confined aquifer where the ambient temperature was 20 C. After a storage period of 51 days, 55, 345 cubic meters of water were produced from the confined aquifer. Throughout the first cycle, which lasted approximately six months, ground water temperatures were recorded at six depths in each of ten observation wells, and hydraulic heads were recorded in five observation wells. During the 41 day production period, the temperature of the produced water varied from 55 C to 33 C, and 66 percent of the injected thermal energy was recovered. The second cycle injection began on 9/23/78 and continued until 11/25/78 when 58,010 cubic meters of water had been recovered. The major problem experienced during the first cycle, a clogging injection well, was reduced by regular backwashing. DOE

N80-30945# Automation Industries, Inc., Richland, Wash. Vitro Engineering Div.
ENVIRONMENTAL DATA FOR SITES IN THE NATIONAL SOLAR DATA NETWORK
Apr. 1980 233 p
(Contracts W-31-109-eng-38; DE-AC01-79CS-30027)
(SOLAR/0010-80/04) Avail: NTIS HC A11/MF A01

The environmental data are presented in the form of tables for each solar site. The solar sites are grouped into 12 zones, each of which consists of several adjacent states. The insolation table presents the total, diffuse, direct, maximum, and extraterrestrial radiation for the solar site. It also shows the ratio of total extraterrestrial radiation, as a percent. The temperature table gives the average, daytime, nighttime, maximum, minimum, and inlet water temperatures for the solar site. Additional tables are presented for some of these solar sites, supplying either wind or relative humidity data, or both. A technical discussion of the instruments and measurements used to obtain these data tables is given, and a map illustrating the climate zones is provided. DOE

N80-30946# Rockwell International Corp., Thousand Oaks, Calif. Electronics Research Center.
ADVANCED PHOTOVOLTAIC CONCENTRATOR CELLS Quarterly Technical Progress Report, 28 Aug. - 30 Nov. 1979
S. W. Zehr, H. T. Yang, and J. S. Harris, Jr. Dec. 1979 43 p refs Prepared for Midwest Research Inst., Golden, Colo.
(Contract EG-77-C-01-4042)
(DSE-4042-T30) Avail: NTIS HC A03/MF A01

Activities demonstrating the technical feasibility of advanced high efficiency concentrator solar converters are described. The approach is to fabricate two cell, non-lattice matched, monolithic stacked converters using optimum pairs of cells having bandgaps in the range of 1.6 to 1.7 eV and 0.95 to 1.1 eV. The low bandgap cells are to be fabricated from AlGaSb(As) compositions by LPE. These subcells are then to be joined into a monolithic structure by an appropriate thermal bonding technique which will also form the needed transparent intercell ohmic contact between the two subcells. The activities this quarter were focused on the development and study of low bandgap cell structures and attempts to develop suitable techniques for the thermal bonding operation. DOE

N80-30947# Tata Inst. of Fundamental Research, Bombay (India). Documentation Center.
SOLAR PASSIVE SYSTEMS FOR BUILDINGS
Mar. 1980 52 p refs
(NP-24377) Avail: NTIS (US Sales Only) HC A04/MF A01; DOE Depository Libraries

A survey is presented of design knowledge and systematic presentation of proven concepts is provided with suitable illustrations. Current design literature was studied to provide an overview of building practices. DOE

N80-30948# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik.
STATIC INVESTIGATION OF ROTOR BLADES AT REST AND UNDER QUASI-STATIONARY LOADING [STATISCHE UNTERSUCHUNG VON ROTORBLAETTERN UNTER EIGENGEWICHT UND IM STATIONAEREN BETRIEB]
J. H. Argyris, K. A. Braun, and B. Kirchgaessner 1979 57 p refs In GERMAN; ENGLISH summary Prepared in cooperation with Bundesministerium fuer Forschung und Technologie, Bonn (West Germany)
(ISD-243; ISSN-0170-6071) Avail: NTIS HC A04/MF A01

The rotor blades of a horizontal axis wind energy converter which have flap and lead-lag freedom as well as a flap-pitch coupling, were dimensioned and studied under both nonoperating deadweight and quasi-stationary loading at constant forces rated operation. With a suitable mass distribution it is possible to drastically reduce the blade bending moments in the flap direction. Materials well known in aircraft construction were considered, among which carbon fiber reinforced plastic is shown to be the most suitable. Most of the blade models were investigated without a lead-lag hinge. Conical oscillation at rated operation was assumed for the layout of these rotor blades. It is reduced considerable for the same blade models when lead-lag freedom is incorporated while maintaining sufficient centrifugal stiffness in the lag direction. Author (ESA)

N80-30949# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik.
STABILITY AND DYNAMIC RESPONSE TO GRAVITATIONAL FORCES OF THE FLAPPING AND LEAD-LAG

HINGES ON A RIGID ROTOR BLADE WITH THE LEADING-EDGE ANGLE OF ATTACK AND FLAPPING BEING COUPLED [STABILITAET UND SCHWERKRAFTRESPONSE DER SCHLAG-SCHWENKBEWEGUNG EINES STARREN ROTORBLATTES MIT BLATTWINKELRUECKSTEUERUNG]

J. H. Argyris and B. Kirchgaessner 1979 53 p refs In GERMAN; ENGLISH summary Prepared in cooperation with Bundesministerium fuer Forschung und Technologie, Bonn (West Germany)

(ISD-244; ISSN-0170-6071) Avail: NTIS HC A04/MF A01

The coupled flapping and lead-lag motion of a single, rigid rotor blade of a wind energy converter with flapping and lead-lag hinges as well as a coupling of the angle of attack with the flapping motion is investigated. The equations of motion are developed under the assumption of linearized quasi-stationary aerodynamic forces. Static and dynamic stability of the coupled flapping and lead-lag motion are investigated. The equations are integrated for different cases under cyclic gravitational forces to get an estimate of the influence of force terms and of the error from the linearization of the conservation expressions.

Author (ESA)

N80-30950# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik.

DYNAMIC ANALYSIS OF A ROTOR BLADE WITH LEAD-LAG FREEDOM, FLAPPING FREEDOM, AND VARIABLE-CONTROLLED BLADE PITCH ANGLE [DYNAMISCHE ANALYSE EINES ROTORBLATTES MIT SCHLAGFREIHEIT, SCHWENKREIHEIT UND BLATTWINKERLUECKSTEUERUNG]

J. H. Argyris, K. A. Braun, and B. Kirchgaessner 1979 95 p refs In GERMAN; ENGLISH summary Prepared in cooperation with Bundesministerium fuer Forschung und Technologie, Bonn (West Germany)

(ISD-258; ISSN-0170-6071) Avail: NTIS HC A05/MF A01

The dynamic behavior of the rotor blades of a wind energy converter with flapping and lead-lag hinges as well as coupling of flapping and blade pitch is investigated. Under the assumption of rigid support of the hub and of constant rotational speed, a linearized system of differential equations of motion is developed using finite element idealization given linearized quasi-stationary aerodynamic forces. For two rotor blade models, which differ only in their stiffness in the lead-lag direction, the complex eigenfrequencies are calculated. Further, the dynamic response of the rotor blades in computed for cyclic gravity loads at rated operation, for a gust, and for the case of tower wake. From the deformation of the structure the stresses at selected points along the blade are derived, while for one version of the rotor blade, torque and rotor thrust are also determined. Author (ESA)

N80-30951# Austrian Solar and Space Agency, Vienna. Abteilung Sonnenenergie.

REGENERATIVE ENERGY SOURCES FOR THE PRODUCTION OF LOW TEMPERATURE HEAT: ENERGY SOURCES, ENERGY TYPES, AND ENERGY CONVERSION; RESULTS AND APPLICATIONS; MEASURES TO PROMOTE USE [REGENERATIVE ENERGIEQUELLEN ZUR ERZEUGUNG VON NIEDERTEMPERATURWAERME. ENERGIEQUELLEN, ENERGIEFORMEN UND ENERGIEUMWANDLUNG; ANWENDUNGEN UND ERFAHRUNGEN; FOERDERUNGSMASSNAHMEN]

Gerhard Faninger and Manfred Bruck 1979 123 p refs In GERMAN; ENGLISH summary

(ISBN-3-7041-0038-2) Avail: NTIS HC A06/MF A01; Austrian Solar and Space Agency, Vienna Sch 25

The experience gained so far concerning the utilization of regenerative energy sources is summarized. Advantages and disadvantages of various systems for the production of low temperature heat are analyzed and recommendations are made for applications regarding hot water production, heating of swimming pools, and space heating. The mechodology of the planning of solar facilities is presented, in addition to a description of the basics of solar technologies. The importance of the utilization of regenerative energy sources is underlined through the presentation of the development of energy management in Austria. The necessity of pursuing measures to accelerate market introduction of solar technology is stressed. A survey of the present measures undertaken for the promotion of solar techniques is given. Author (ESA)

N80-30952# Acurex Corp., Mountain View, Calif. Energy and Environmental Div.

PILOT SCALE COMBUSTION EVALUATION OF WASTE AND ALTERNATE FUELS, PHASE 3 Final Report, Feb. - Aug. 1978

R. A. Brown and C. F. Busch Mar. 1980 227 p refs (Contract EPA-68-02-1885)

(PB80-177413; EPA-600/7-80-043) Avail: NTIS HC A11/MF A01 CSCL 13B

The results of three studies which evaluated the combustion of waste products and alternate fuels are presented. The first evaluated a distributed air staging concept for NOx control in pulverized coal fired systems. The second evaluated combustion control techniques and NO emissions when firing coal/oil mixtures. The third evaluated emissions and combustion characteristics of refuse derived fuel (RDF) cofired with either natural gas or pulverized coal. GRA

N80-30953# National Technical Information Service, Springfield, Va.

THERMIONIC ENERGY CONVERSION. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1977 - May 1980

William E. Reed Jun. 1980 135 p Supersedes NTIS/PS-79/0596; NTIS/PS-78/0591

(PB80-810906; NTIS/PS-79/0596; NTIS/PS-78/0591) Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 10B

Research on thermionic power generation, power plant design, converter design, and basic research on thermionic materials are cited. Spacecraft applications are included. This updated bibliography contains 129 abstracts, 23 of which are new entries to the previous edition. GRA

N80-30954# National Technical Information Service, Springfield, Va.

MAGNETOHYDRODYNAMIC GENERATORS IN POWER GENERATION. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - May 1980

William E. Reed Jun. 1980 278 p Supersedes NTIS/PS-79/0608; NTIS/PS-78/0528

(PB80-810856; NTIS/PS-79/0608; NTIS/PS-78/0578) Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 10B

The citations include research on performance, costs, efficiency, and design of MHD generators and their use in fusion and fission reactors, and fossil fueled plants. This updated bibliography contains 272 abstracts, 40 of which are new entries to the previous edition. GRA

N80-30955# National Bureau of Standards, Washington, D.C. National Measurement Lab.

MATERIALS FOR FUEL CELLS Annual Report, Jan. - Dec. 1978

L. H. Bennett, C. K. Chiang, M. I. Cohen, A. L. Dragoo, A. D. Franklin, and A. J. McAlister Mar. 1980 89 p refs

(PB80-182355; NBSIR-80-1991) Avail: NTIS HC A05/MF A01 CSCL 10B

The Materials for Fuel Cells Program at NBS during this year consisted of three major elements which taken together reinforce each other in techniques and concepts; these elements embrace: (1) electrocatalysis, especially hydrogen oxidation, on non noble metals and alloys; (2) degradation mechanisms involving solid oxygen-transporting electrolytes; and (3) development of instruments. GRA

N80-30956# National Technical Information Service, Springfield, Va.

WIND POWER. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1977 - 1978

Audrey S. Hundemann Jun. 1980 263 p

(PB80-811433) Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 10B

The feasibility, use, and engineering aspects of wind power and windmills are discussed in these citations of Federally funded research reports. Abstracts primarily cover the use of wind power for electric power generation and wind turbine design and performance. General studies dealing with comparative analyses

of wind power and alternative energy sources are included, as are energy storage devices which can be used in these systems. This updated bibliography contains 253 abstracts, none of which are new entries to the previous edition. GRA

N80-30957# National Technical Information Service, Springfield, Va.
WIND POWER. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1978 - May 1980
Audrey S. Hundemann Jun. 1980 305 p Supersedes NTIS/PS-79/0536; NTIS/PS-78/0417
(PB80-811441; NTIS/PS-79/0536; NTIS/PS-78/0417) Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 10B

Windmill and wind power feasibility, use, and engineering are discussed in these citations of worldwide research. Abstracts primarily cover the use of wind power for electric power generator and wind turbine design and performance. General studies dealing with the use of wind power in developing countries and comparative analyses of wind power and alternative energy sources are included, as are studies on energy storage systems. This updated bibliography contains 299 abstracts, 174 of which are new entries to the previous edition. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N80-30958# California Univ., Irvine.
PROCEEDINGS OF THE CONFERENCE ON ENVIRONMENTAL TOXICOLOGY
Apr. 1980 292 p refs Conf. held at Dayton, Ohio, 13-15 Nov. 1979
(Contract F33615-76-C-5005; AF Proj. 6302)
(AD-A086341; AFAMRL-TR-79-121) Avail: NTIS HC A13/MF A01 CSCL 06/2

Major technical areas discussed included environmental hazards of fibrous dusts, toxicokinetics of inhaled gases and vapors, and the environmental hazards of toxicants in surface water systems. The oncogenic effects of hydrazine in animal models and immunotoxic reactions as manifested by skin and lung hypersensitivity was presented. GRA

N80-30959# Institute of Ecology, Indianapolis, Ind.
CARBON DIOXIDE EFFECTS RESEARCH AND ASSESSMENT PROGRAM. THE ROLE OF TEMPERATE ZONE FORESTS IN THE WORLD CARBON CYCLE: PROBLEM DEFINITION AND RESEARCH NEEDS
T. V. Amentano, ed. and J. Hett, ed. Feb. 1980 76 p refs Workshop held at Indianapolis, 23-24 Mar. 1980
(DE-AC02-79EV-10040)
(CONF-7903105) Avail: NTIS HC A05/MF A01

Existing data on growth and utilization of the temperate zone forest carbon pool are examined and further research needs in relation to the role of temperate forests in the global carbon cycles are identified. Topics covered include: (1) current trends in temperate zone forests in North America, Europe, and Asia; (2) regional analysis of forest carbon exchange in New England and the Southeastern United States; (3) policy aspects of a temperate zone forest research program; (4) limitations to the analysis of temperate zone forest carbon exchange; and (5) growth trends in commercial forests of North America; and (6) the influence of civilization upon European and Asian forests. DOE

N80-30960# Oak Ridge National Lab., Tenn.
EVALUATION OF UNCERTAINTIES IN SELECTED ENVIRONMENTAL DISPERSION NEEDS
Craig A. Little and Charles W. Miller 1979 4 p refs Presented at Am. Nucl. Soc. Meeting, San Francisco, 12 Nov. 1979
(Contract W-7405-eng-26)
(CONF-791103-10B) Avail: NTIS HC A02/MF A01

Compliance with standards of radiation dose to the general public has necessitated the use of dispersion models to predict radionuclide concentrations in the environment due to releases from nuclear facilities. Because these models are only approximations of reality and because of inherent variations in the input parameters used in these models, their predictions are subject to uncertainty. Quantification of this uncertainty is necessary to assess the adequacy of these models for use in determining compliance with protection standards. The capabilities of several dispersion models to predict accurately pollutant concentrations in environmental media are characterized. Three types of models are discussed: aquatic or surface water transport models, atmospheric transport models, and terrestrial and aquatic food chain models. Using data published primarily by model users, model predictions are compared to observations. DOE

N80-30961# Aspen Inst. for Humanistic Studies, Boulder, Colo.
MODELING THE PROSPECTS FOR CLIMATIC CHANGE: CURRENT STATE-OF-THE-ART AND IMPLICATIONS
William W. Kellogg 4 Apr. 1980 44 p refs Presented at the Econ. Methodologies for Climate Change, Ft. Lauderdale, Fla., 24 Apr. 1980 Prepared in cooperation with the National Center for Atmospheric Research, Boulder, Colo.
(Contract DE-AC02-79EV-10281)
(CONF-800474-1) Avail: NTIS HC A03/MF A01

Expected changes in the world's climate, primarily as a result of anthropogenic perturbations to the global carbon cycle brought about by fossil fuel burning and large scale deforestation are discussed. The status of our ability to model the planetary system that determines the climate is summarized. DOE

N80-30962# Oak Ridge National Lab., Tenn. Health and Safety Research Div.
USERS MANUAL FOR DWNWND: AN INTERACTIVE GAUSSIAN PLUME ATMOSPHERIC TRANSPORT MODEL WITH EIGHT DISPERSION PARAMETER OPTIONS
David E. Fields and Charles W. Miller May 1980 39 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6874) Avail: NTIS HC A03/MF A01

The computer code DWNWND is an interactive implementation of the Gaussian plume model. It allows the user to specify any one of eight different sets of the empirically determined dispersion parameters. Using the selected dispersion parameters, ground-level normalized exposure estimates are made at any specified downwind distance. Computed values may be corrected for plume depletion due to deposition and for plume settling due to gravitational fall. With this interactive code, the user chooses values for ten parameters which define the source, the dispersion and deposition process, and the sampling point. DWNWND is written FORTRAN for execution on a PDP 10 computer, requiring less than one second of central processor unit time for each simulation. DOE

N80-30963# Brookhaven National Lab., Upton, N. Y. Dept. of Energy and Environment.
DELIQUESCENCE PROPERTIES AND PARTICLE SIZE CHANGE OF HYDROSCOPIC AEROSOLS
Ignatius N. Tang 1979 23 p refs Presented at the Symp. on Biol. Studies of Environ. Pollutants: Aerosol Generation and Exposure Facilities, Honolulu, Hawaii, 1 Apr. 1979
(Contract EY-76-C-02-0016)
(BNL-27094; CONF-7904123-1) Avail: NTIS HC A02/MF A01

The deliquescent properties of pure and mixed salt aerosols and the particle size change as a function of relative humidity are discussed. Experimental results are presented for the growth of mixed chlorides (NaCl-KCl), mixed sulfates (H2SO4-(NH4) 2SO4), and mixed (NH4)2SO4-NH4NO3 aerosol systems. It is shown that the behavior of the mixed salt aerosols in a moist atmosphere can be predicted from phase diagrams and pertinent thermodynamic properties of the bulk solutions. The evaporation of a saline droplet in an atmosphere of decreasing humidities is also investigated experimentally. For each deliquescent salt aerosol, there is a threshold humidity below which the solution droplets will quickly evaporate to become crystalline particles. The information is useful in the selection of a suitable humidification procedure to generate test aerosols for exposure studies. DOE

N80-30964# Environmental Protection Agency, Ann Arbor, Mich. Test and Evaluation Branch.
EVALUATION OF THE RAM-JET DEVICE, A PCV AIR BLEED

Edward Anthony Barth Jan. 1980 14 p
(PB80-170657; EPA-AA-TAEB-80-10) Avail: NTIS
HC A02/MF A01 CSCL 13F

The potential for emission reduction or fuel economy improvement compared to conventional engines and vehicles was determined for retrofit device designed to bleed in extra air to the engine by allowing ambient air to bypass the carburetor under high engine load conditions. GRA

N80-30968# TRW Systems and Energy, Redondo Beach, Calif.
TOTAL PARTICULATE MASS EMISSION SAMPLING ERRORS Final Report, Nov. 1976 - Apr. 1977
E. F. Brooks Jul. 1979 52 p refs
(Contract EPA-68-02-2165)
(PB80-181910; EPA-600/7-79-155) Avail: NTIS
HC A04/MF A01 CSCL 13B

A first cut estimate of sampling errors in the measurement of total particulate mass emissions from stationary sources is given. Measurement errors are divided into two general categories: sampling errors and analysis errors. Total particulate mass sampling errors are evaluated within the framework of a system error analysis. The evaluation leads to a ranking of individual error sources and estimates of total system error. Analysis results show that a Level 1 should have a sampling accuracy of better than a factor of + or - 2, with a confidence of 95%, except at a control device outlet where the accuracy is more likely to be a factor of + or - 3, especially if the control device is an electrostatic precipitator. GRA

N80-30969# North Carolina Univ. at Chapel Hill. School of Public Health.
PHOTOCHEMICAL STUDY OF NOx REMOVAL FROM STACK GASES Final Report, Jan. 1977 - Mar. 1979
John R. Richards and Donald L. Fox Mar. 1980 202 p refs
(Grant EPA-R-804740)
(PB80-181274; EPA-600/7-80-038) Avail: NTIS
HC A10/MF A01 CSCL 07E

The technical feasibility of a photochemical pretreatment system for NOx control at coal fired boilers is evaluated. The approach utilizes reaction mechanisms similar to those responsible for photochemical oxidant incidents. The reactions are initiated under controlled conditions while the pollutants are at high concentration and while the reaction products can be removed. Results indicate that, under time and light limited conditions, it is possible to quench the photochemical reactions at the NC2 peak and prior to the formation of ozone, aerosols, and other secondary products. Photochemical oxidation of NO was insensitive to SO2 concentration and CO2 concentration. The photochemical system appears compatible with conditions resulting from combustion modifications to suppress NOx generation. GRA

N80-30967# Bowdoin Coll., Brunswick, Maine.
THE BENEFITS OF AIR AND WATER POLLUTION CONTROL: A REVIEW AND SYNTHESIS OF RECENT ESTIMATES Final Report
Myrick A. Freeman, III Dec. 1979 191 p refs Sponsored by Council on Environmental Quality
(PB80-178759) Avail: NTIS HC A09/MF A01 CSCL 13B

A critical reveiw of previous studies which estimate air and water pollution control benefits in monetary terms or which might provide an empirical basis for such an estimate is given. The reasons for the estimates to be so different are discussed and benefit estimates are recalculated whenever possible on the basis of common assumptions concerning price level, base period, degree of cleanup, and imputed values in order to compare the different estimates. GRA

N80-30966# City Coll. of the City Univ. of New York. Dept. of Electrical Engineering.
REMOTE MONITORING OF GASEOUS POLLUTANTS BY DIFFERENTIAL ABSORPTION LASER TECHNIQUES Final Report, Jun. 1974 - Jun. 1978
S. A. Ahmed, J. S. Gergely, and F. Barone Feb. 1980 217 p refs
(Grant EPA-R-803109)
(PB80-179351; EPA-600/2-80-049) Avail: NTIS
HC A10/MF A01 CSCL 13B

A single ended laser radar (LIDAR) system was designed, built, and successfully operated to measure range resolved concentrations of NO2, SO2, and O3 in the atmosphere using a Differential Absorption of Scattered Energy LIDAR technique. For the NO2 measurements, the dye laser output was used directly in a novel simultaneous two wavelength output mode in which two wavelengths, one on and one off the resonance absorption of NO2 molecules are transmitted simultaneously and the relative attenuation determined for the two backscattered signals detected. For the SO2 and O3 measurements, it was necessary to frequency double the output of the dye laser to match the absorption spectra of the SO2 and O3 molecules. GRA

N80-30969# Environmental Research Lab., Athens, Ga.
SURVEY ANALYSIS OF PHENOLIC COMPOUNDS IN INDUSTRIAL EFFLUENTS BY GAS CHROMATOGRAPHY MASS SPECTROMETRY
W. M. Shackelford and R. G. Webb 1979 15 p refs Submitted for publication
(PB80-177793; EPA-600/J-79-056) Avail: NTIS
HC A02/MF A01 CSCL 07D

Use of continuous liquid-liquid extractor improved the recovery of phenolic compounds from those effluents that formed intractable emulsions during liquid-liquid extraction by shake-out. Tenax GC and SP1240 DA proved to be the best general purpose gas chromatographic column packings for a broad range of phenolic compounds. Derivatization procedures using diazomethane and pentafluorobenzyl bromide were found to be successful only under rigorously controlled conditions. For survey work, it appears that derivatization is of questionable value for initial qualitative analysis because, in many cases, the character of the matrix is not known. GRA

N80-30970# Systems Applications, Inc., San Rafael, Calif.
MODELLING OF SIMULATED PHOTOCHEMICAL SMOG WITH KINETIC MECHANISMS. VOLUME 2 CHEMK: A COMPUTER MODELING SCHEME FOR CHEMICAL KINETICS Final Report
G. Z. Whitten and H. Hogo Feb. 1980 115 p refs
(Contract EPA-68-02-2428)
(PB80-181084; EPA-600/3-80-028B) Avail: NTIS
HC A06/MF A01 CSCL 07E

Mechanisms that describe the formation of photochemical smog are developed using a computer modeling technique directed toward the simulation of data collected in two smog chambers: an indoor chamber and a dual outdoor chamber. Individual compounds for which specific experiments were simulated and mechanisms developed include the following: formaldehyde, acetaldehyde, ethylene, propylene, butane, and toluene. The user's manual and coding for a chemical kinetics computer program, CHEMK, is contained. GRA

N80-30971# Office of Science and Technology, Washington, D. C.
SCIENTIFIC AND TECHNICAL NEEDS FOR HAZARDOUS WASTE MANAGEMENT
Louis H. Blair, Carl. R. Gerber, and Leonard C. Slosky Oct. 1979 58 p
(PB80-177173) Avail: NTIS HC A04/MF A01 CSCL 13B

Recommendations for research and technology development and for the application of existing knowledge are given. Recommendations with longer term implications call for: improved procedures and data to define wastes and waste sites in terms of the degree of hazard they pose to human health and the environment; new and improved technologies for destroying or detoxifying future waste streams as well as mixtures of wastes already in 'problem' sites; criteria for siting new facilities; and an environment research center dedicated to hazardous waste. GRA

N80-30972# Environmental Protection Agency, Research Triangle Park, N.C. Quality Assurance Div.
AN EVALUATION STUDY OF EPA METHOD 8 Final Report
Joseph E. Knoll and M. Rodney Midgett Mar. 1980 44 p refs
(PB80-181936; EPA-600/4-80-018) Avail: NTIS

HC A03/MF A01 CSCL 07D

Techniques used in the source test method for acid mist and sulfur dioxide emissions from sulfuric acid plants are evaluated. Evidence is shown that trace amounts of peroxides in isopropyl alcohol (IPA) result in the conversion of sulfur dioxide to sulfate and cause positive errors in acid mist values. Methods for measuring and purifying IPA are described. Collection efficiencies of train components are described and two alternate indicators are evaluated. Solid ammonium sulfates's use as audit samples is discussed. Field testing is also described in which paired probe techniques were employed. Both ammonia and dimethyl aniline, which are employed as gas scrubbers, cause sulfur dioxide to be retained in the isopropyl alcohol and result in large positive interferences in acid mist values. Ferric oxide, present in the effluents of steel pickling operations, causes a large negative interference in acid mist values. GRA

N80-30972# Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e. V., Grafschaft (West Germany). Inst. of Toxicology and Aerosol Research.

DESIGN AND PERFORMANCE OF AN AEROSOL MASS DISTRIBUTION MONITOR Final Report, 1977 - 1979

W. Stoeber, F. J. Moenig, H. Flachsbart, and N. Schwarzer Mar. 1980 53 p refs

(Grant EPA-R-803592)

(PB80-179310; EPA-600/2-80-053) Avail: NTIS HC A04/MF A01 CSCL 14B

The instrument consists of a newly designed spiral duct aerosol centrifuge equipped with highly sensitive quartz sensors for in situ weighing of the deposited aerosol masses. The instrument further includes a clean air device for maintaining constant aerosol flow conditions, and electronic parts for the operation of the quartz sensors. The mass of aerosol deposited on the quartz crystals is automatically measured by an electronic counter while the rotor of the centrifuge continues spinning. The data are handled by a microprocessor. GRA

N80-30974# Lincoln Lab., Mass. Inst. of Tech., Lexington. Div. of Applied Research/ASRA.

TUNABLE LASER SURVEY OF MOLECULAR AIR POLLUTANTS: DOPPLER-LIMITED SPECTRA OF THE C-H STRETCHING BANDS OF FORMALDEHYDE, ETHYLENE, ETHANE AND ALLENE Final Report

A. S. Pine Jan. 1980 145 p refs

(Grant NSF DAR-78-24562)

(PB80-180003; NSF/RA-800011) Avail: NTIS HC A07/MF A01 CSCL 07D

High resolution (Doppler limited) near infrared spectra of several hydrocarbons and other light molecules of atmospheric significance were surveyed and catalogued using a unique difference frequency laser spectrometer. Such spectra can be applied to the detection, identification, and quantitative monitoring of molecular air contaminants using lasers or other high resolution spectroscopic instruments. The complete Doppler limited spectra of the complex and rich C-H stretching bands of formaldehyde (H_2CO), ethylene (C_2H_4), ethane (C_2H_6), and allene (C_3H_4) are presented. Precise frequencies and intensities of the spectral lines also are listed in an atlas for each molecule along with assignments, made by several collaborators, for most of the observed transitions. GRA

N80-30975# Dames and Moore, Bethesda, Md.

REPORT OF THE NCAQ ATMOSPHERIC DISPERSION MODELING PANEL VOLUME 1: RECOMMENDATIONS Final Report

M. W. Chandler, J. Lewis, B. Zalcman, J. I. Kelly, A. F. Nugent, G. S. Hoopes, J. Mikula, and J. J. Herrman Mar. 1980 87 p refs Conf. held at Reston, Va., 13-16 Nov. 1979

(Contract NCAQ-5-AQ-7379)

(PB80-174964; AQ-7379-1) Avail: NTIS HC A05/MF A01 CSCL 04A

Uses and limitations of currently available models for air quality management, and appropriate dispersion models and/or technical approaches to be considered in the evaluation of the Clean Air Act are given. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N80-30976 Washington Univ., St. Louis, Mo.

MICROCHARACTERIZATION OF INTERPLANETARY DUST COLLECTED IN THE EARTH'S STRATOSPHERE Ph.D. Thesis

Philip Bernard Fraundorf 1980 352 p

Avail: Univ. Microfilms Order No. 8018727

The internal structure of thirteen 10 micrometer aggregates were examined using selected techniques from the field now known as analytical electron microscopy. The aggregates were collected in the Earth's stratosphere at 20 km altitude by impactors mounted on NASA U-2 aircraft. Eleven of them exhibited relative major element abundances similar to those found in chondritic meteorites. For this and other reasons, these eleven particles are believed to represent relatively unaltered interplanetary dust. Interplanetary dust is thought to be of cometary origin, and comets in turn provide the most promising reservoir for unaltered samples of materials present during the collapse of the solar nebula. It is shown that the chondritic aggregates probably contain important information on a wide range of processes in the early solar system. The observations are consistent with the hypotheses that: (1) the particles represent fragments of interplanetary dust; (2) some of them have not been significantly altered by thermal or radiation processes since their assembly; (3) interplanetary dust is of cometary origin; and (4) the dust parent materials consist of a wide range of relatively unaltered leftovers from the collapse of the solar nebula. Dissert. Abstr.

N80-30977 California Univ., San Diego.

STUDY OF SEISMIC WAVE EXCITATION FOR TWO EARTHQUAKES IN NORTHERN BAHA, CALIFORNIA Ph.D. Thesis

Nava Pichardo 1980 293 p

Avail: Univ. Microfilms Order No. 8018794

Two earthquakes of comparable local magnitude from different regions of northern Baja California are studied to explore possible causes for the observed stronger excitation of surface waves by earthquake from the Delta region (relative to earthquake of comparable local magnitude in the Peninsular Ranges region). Consideration of how the magnitude and moment determinations are related to the spectra of the two earthquakes exemplifies how departure from the implicit spectral and time similarity makes the corrections (or implied corrections) for period in the magnitude definitions inconsistent in relation to other scaling parameters. Also illustrated is how short period measurements, like Ml and mb will sample longer periods for an earthquake with a longer source time function, and how the time window implicit in the determination of magnitudes (and in some methods of moment determination in the time domain) may represent only part of the seismic energy contributing to the seismogram.

Dissert. Abstr.

N80-30978*# Smithsonian Astrophysical Observatory, Cambridge, Mass.

A REPORT ON THE GRAVITATIONAL REDSHIFT TEST FOR NON-METRIC THEORIES OF GRAVITATION Final Report, 1 Feb. - 31 Aug. 1980

Aug. 1980 55 p refs

(Grant NsG-8059)

(NASA-CR-163496) Avail: NTIS HC A04/MF A01 CSCL 08E

The frequencies of two atomic hydrogen masers and of three superconducting cavity stabilized oscillators were compared as the ensemble of oscillators was moved in the Sun's gravitational field by the rotation and orbital motion of the Earth. Metric gravitation theories predict that the gravitational redshifts of the two types of oscillators are identical, and that there should be no relative frequency shift between the oscillators; nonmetric theories, in contrast, predict a frequency shift between masers and SCSOs that is proportional to the change in solar gravitational potential experienced by the oscillators. The results are

consistent with metric theories of gravitation at a level of 2%. T.M.

N80-30979*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
STUDY AND EVALUATION OF IMPULSE MASS SPECTROMETERS FOR ION ANALYSIS IN THE D AND E REGIONS OF THE IONOSPHERE Final Report, 1 Jun. 1965 - 31 Dec. 1979
Bruce R. Kendall 31 Dec. 1979 176 p refs
(Grant NGL-39-009-032)
(NASA-CR-163490) Avail: NTIS HC A09/MF A01 CSCL 04A

Theoretical and numerical analyses were made of planar, cylindrical and spherical electrode time-of-flight mass spectrometers in order to optimize their operating conditions. A numerical analysis of potential barrier gating in time-of-flight spectrometers was also made. The results were used in the design of several small mass spectrometers. These were constructed and tested in a laboratory space simulator. Detailed experimental studies of a miniature cylindrical electrode time of flight mass spectrometer and of a miniature hemispherical electrode time of flight mass spectrometer were made. The extremely high sensitivity of these instruments and their ability to operate at D region pressures with an open source make them ideal instruments for D region ion composition measurements. T.M.

N80-30980*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPHERICAL EARTH ANALYSIS AND MODELING OF LITHOSPHERIC GRAVITY AND MAGNETIC ANOMALIES Ph.D. Thesis - Purdue Univ.
R. R. B. vonFrese (Purdue Univ.), W. J. Hinze (Purdue Univ.), and L. W. Braile (Purdue Univ.) May 1980 180 p refs
(Contract NAS5-25030)
(NASA-TM-80709) Avail: NTIS HC A09/MF A01 CSCL 08E

A comprehensive approach to the lithospheric analysis of potential field anomalies in the spherical domain is provided. It has widespread application in the analysis and design of satellite gravity and magnetic surveys for geological investigation. T.M.

N80-30981*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SIMULTANEOUS MEASUREMENTS OF MAGNETOTAIL DYNAMICS BY IMP SPACECRAFT
Donald H. Fairfield, Ronald P. Lepping, E. W. Hones, Jr. (LASL), S. J. Bame (LASL), and J. R. Asbridge (LASL) Aug. 1980 49 p refs Submitted for publication
(NASA-TM-81985) Avail: NTIS HC A03/MF A01 CSCL 03B

Changes in tail energy density during substorms in the magnetotail are given. In addition to plasma sheet thinnings seen prior to substorm onsets, a gradual decrease in plasma beta was detected in the deep tail which precedes onset and the more prominent plasma disappearance that typically accompanies it. The frequency of thinnings and the regions over which they occurred indicate that drastic changes in plasma sheet thickness are common features of substorms which occur at all locations across the tail. T.M.

N80-30982# Naval Research Lab., Washington, D. C.
EXPERIMENTS ON THE JUNCTION OF RELATIVISTIC ELECTRON BEAMS INTO PREFORMED CHANNELS IN THE ATMOSPHERE: A FEASIBILITY STUDY Interim Report
M. Raleigh, J. D. Sethian, R. B. Fiorito, L. Allen, R. F. Fernsler, and J. R. Greig 13 May 1980 49 p refs
(RR0110901)
(AD-A086732; AD-E000452; NRL-MR-4220) Avail: NTIS HC A03/MF A01 CSCL 04/1

A study was made of the interaction of an intense relativistic electron beam (REB) with a preformed reduced density channel in the atmosphere. The channel was designated by laser induced, aerosol initiated air breakdown and was heated by passage of an electric current. However, at the time the REB was injected into the channel no externally applied heating current remained. By varying the time between creation of the hot channel and injection of the REB, we were able to observe interactions of the beam with both high conductivity and low conductivity channels. In the former case the beam did not propagate in the channel, whereas in the latter case the beam did propagate in the channel. These results are discussed in terms of the residual conductivity in the channel, and in terms of the radius of the return current distribution compared to that of the beam. GRA

N80-30983# Air Force Geophysics Lab., Hanscom AFB, Mass. Space Physics Div.
COMPARISON OF RESULTS FROM THE S3-2 SATELLITE AND THE CHATANIKA RADAR IN AN EARLY MORNING AURORA Interim Report
Roger P. Vancour and Bertram M. Shuman 22 Oct. 1979 18 p refs
(AF Proj. 2311)
(AD-A086861; AFGL-TR-79-0254; AFGL-ERP-680) Avail: NTIS HC A02/MF A01 CSCL 04/1

During orbit 6352, the Air Force satellite S3-2 passed by the Chatanika radar in a trajectory that was only 12 deg off from the geomagnetic meridian along which the radar scanned. This report presents the analysis of the data for this orbit from the triaxial fluxgate magnetometer, the electrostatic analyzer aboard the satellite, and the radar data. These data were obtained simultaneously during a morning active aurora. Comparisons of current densities determined by these experiments are made, and the agreement between the electrostatic analyzer precipitating electron fluxes and the electron densities determined from the radar data is shown. GRA

N80-30984# Naval Research Lab., Washington, D. C.
INFLUENCE OF MAGNETIC SHEAR ON THE CURRENT CONVECTIVE INSTABILITY IN THE DIFFUSE AURORA
J. D. Huba and S. L. Ossakow 16 Apr. 1980 21 p refs
(RR0330244)
(AD-A086789; AD-E000443; NRL-MR-4219) Avail: NTIS HC A02/MF A01 CSCL 04/1

The influence of magnetic shear on the current convective instability is investigated for conditions typical of the high latitude F region during the diffuse aurora. It is found that magnetic shear (1) reduces the growth rate of the instability (although it does not stabilize the mode); and (2) substantially localizes the mode structure parallel to the density gradient. GRA

N80-30985# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
PLASMA FIELD STUDIES DURING MAGNETIC DISTURBANCES Final Report, Aug. 1979 - Jun. 1980
W. P. Olson, K. A. Pfitzer, and S. J. Scotti 30 Jun. 1980 39 p refs
(Contract N00014-79-C-0791)
(AD-A086420) Avail: NTIS HC A03/MF A01 CSCL 04/1

This work summarizes the work performed during the contract period. The goal was the development of quantitative disturbed-time magnetic and electric field in the magnetosphere. The July 29, 1980 event was the model disturbance used to develop a realistic magnetic and electric field model for a disturbed period. GRA

N80-30986# Logicon, Inc., Lexington, Mass.
CONDENSED STORAGE OF DIFFUSION EQUATION SOLUTIONS FOR ATMOSPHERIC DENSITY MODEL COMPUTATIONS
James N. Bass 25 Jan. 1980 13 p refs
(Contract F19628-78-C-0209; AF Proj. 9993)
(AD-A086868; AFGL-TR-80-0038; SR-1) Avail: NTIS HC A02/MF A01 CSCL 04/1

It is shown that all neutral thermospheric component densities in diffusive equilibrium can be derived from a single function of height. This is used to permit considerable savings in storage of Jacchia 1977 model densities compared to storing the solution for each component, which requires use of external random access files. The single solution can be built into the computer code, making it more transportable to different computers. A subroutine has been developed implementing this method, including the latest results for atomic nitrogen and the non-diffusive equilibrium solution for atomic hydrogen. GRA

N80-30987# Epsilon Labs., Bedford, Mass.
SATELLITE DENSITY GAUGE INSTRUMENTATION PROGRAM Final Report, 11 Jan. 1977 - 30 Dec. 1978
Carl A. Accardo and John Dulchinos Jan. 1980 72 p refs
(Contracts F19628-77-C-0062; F19628-74-C-0158; AF Proj. 6690)
(AD-A086809; AFGL-TR-80-0035) Avail: NTIS HC A04/MF A01 CSCL 09/1

The report contains a description of a U.S. Air Force Geophysics Laboratory Atmosphere Density experiment. Two instruments developed under an earlier program were qualified for space flight and were flown in the spring of 1978. Discussion of instrument performance and flight results are presented. GRA

N80-30988# Analytic Sciences Corp., Reading, Mass.
A FAST ESTIMATION ALGORITHM FOR TWO-DIMENSIONAL GRAVITY DATA, GEOFAST
Kevin S. Tait 15 Nov. 1979 83 p refs
(Contract F19628-77-C-0152; AF Proj. 3204)
(AD-A086835; TASC-TR-868-1-1; AFGL-TR-80-0016; SR-2) Avail: NTIS HC A05/MF A01 CSCL 08/5

This report describes an algorithm for the efficient computation of minimum variance estimates from large amounts of two dimensional gravity data. The method (called GEOFAST for 'geodetic fast estimation') is based on the fast Fourier transform and takes advantage of the underlying structure of the statistical models in the frequency domain. An approximate solution is obtained in a number of computer operations proportional to N log sub 2, where N is the number of data points and the proportionality constant is controlled by the desired level of accuracy. Results are presented from two test cases, using GEOS-3 radar altimeter data to estimate mean gravity anomalies, which verify the efficiency and accuracy of the algorithm. GRA

N80-30989# Naval Research Lab., Washington, D. C.
AURORAL ELECTRODYNAMICS I. 1: PRELIMINARY ELECTRON DENSITY PROFILE. 2: VEHICLE POTENTIAL CHANGES DURING AN ACTIVE BEAM EXPERIMENT Memorandum Report
D. N. Walker, J. C. Holmes, and E. P. Szuszewicz 19 May 1980 16 p refs
(RR0330244)
(AD-A086728; AD-E000455; NRL-MR-4229) Avail: NTIS HC A02/MF A01 CSCL 04/1

The report presents preliminary findings obtained by a pulsed plasma probe aboard a payload launched by a Terrier-Malemute sounding rocket from the Poker Flat Research Range. Results are outlined both during passive and active (i.e., an Argon plasma gun) experiments. Modifications to the design of the pulsed probe circuitry which allow tracking of the vehicle potential are described. The vehicle potential deduced from the analog records is plotted during times of interest (gun pulsing periods). An electron density profile with gun pulsing times indicated is also provided. GRA

N80-30990# Reims Univ., France. Lab. de Physique Moleculaire.
ATLAS OF THE INFRARED FREQUENCIES OF OZONE, PART 1 [ATLAS DES FREQUENCES INFRAROUGES DE L'OZONE. 1 PARTIE]
1979 131 p In FRENCH 2 Vol.
Avail: NTIS HC A07/MF A01

The frequency, energy, and relative intensity of ozone resonances in the infrared are given in tabular form. For part 2 see N80-30991. Author (ESA)

N80-30991# Reims Univ., France. Lab. de Physique Moleculaire.
ATLAS OF THE INFRARED FREQUENCIES OF OZONE, PART 2 [ATLAS DES FREQUENCES INFRAROUGES DE L'OZONE. 2 PARTIE]
1979 161 p In FRENCH 2 Vol.
Avail: NTIS HC A08/MF A01

The frequency, energy, and relative intensity of ozone resonances in the infrared are given in tabular form. For part 1 see N80-30990. Author (ESA)

N80-30992# Max-Planck-Institut fuer Aeronomie, Lindau Uber Northeim (West Germany).
SOUNDING ROCKET PROGRAM AERONOMY. PROJECT UPPER POLAR ATMOSPHERE. SUPRA-THERMAL AURORAL PARTICLE OBSERVATIONS Final Report
Klaus Wilhelm Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1979 42 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-79-03) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 8,40

The scientific objectives of a supra-thermal particle experiment launched on four sounding rocket payloads in the framework of the project 'upper polar atmosphere' are described, as well as the design, development and calibration activities. The data obtained are presented in various stages of the data reduction process to facilitate co-operative scientific interpretations incorporating all measurements taken by the payloads. Author (ESA)

N80-30993# Technische Universitaet, Brunswick (West Germany). Inst. fuer Geophysik und Meteorologie.
ROCKET MEASUREMENT OF TOROIDAL MAGNETIC FIELDS IN AN EQUATORIAL ELECTROJET: METHOD OF EVALUATION [RAKETENMESSUNGEN TOROIDALER MAGNETFELDER IM AEQUATORIALEN ELEKTROJET: AUSWERTUNGS METHODE]
Guenter Musmann 1979 75 p refs In GEORGIAN
(GAMMA-34) Avail: NTIS HC A04/MF A01

A rocket experiment was conducted in 1970 in Brazil to demonstrate the existence of the toroidal magnetic fields of the equatorial electrojet by means of Sun sensors, azimuth sensors and magnetometers. The calculation of the Earth's magnetic field with the D component (declination), I (inclination), and the position of the Sun (zenith distance and azimuth) are useful for the exploitation of the results. An evaluation method is proposed which allows the determination of the rotation of the declination due to the toroidal magnetic field. Author (ESA)

N80-30994# Midwest Research Inst., Kansas City, Mo.
EARTHQUAKE RISK AND DAMAGE FUNCTIONS: AN INTEGRATED PREPAREDNESS AND PLANNING MODEL APPLIED TO NEW MADRID Final Report
Ben-Chieh Liv, Chang-Tseh Hsieh, Robert Gustafson, Otto Nuttli, Richard Gentile, and William Park 7 Dec. 1979 335 p refs
(Grant NSF ENV-77-15669)
(PB80-170368; NSF/RA-790428) Avail: NTIS HC A15/MF A01 CSCL 08K

The methodology and the data needed to guide public and private planning and future decision making for earthquake hazard preparedness and risk mitigation are presented. The focus is on the New Madrid Fault region, especially the effect on the St. Louis and Memphis Standard Metropolitan Statistical Areas. An interdependent planning simulator model was developed to tie together statistically the seismic risk or physical damage functions to economic damage functions for potential earthquake risk assessment and impact evaluation for the next 50 years. GRA

N80-30995# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
A MULTIDIRECTIONAL PHOTODIODE ARRAY FOR THE MEASUREMENT OF SOLAR RADIANCES
J. M. Davis, C. Vogel, and S. K. Cox Feb. 1980 51 p refs Sponsored in part by Eppley Lab., Inc.
(Grant NSF ATM-78-12631)
(PB80-181753; AS-PAPER-322; ISSN-0067-0340) Avail: NTIS HC A04/MF A01 CSCL 04A

An instrument designed to measure the angular variation of radiance field in the .3 to 1.1 micrometers spectral bandpass is described. The instrument consists of thirteen photodiode detectors mounted in fixed positions. Data analysis procedures designed to produce a continuous depiction of the radiance field over a 2 pi steradian solid angle from the thirteen discrete observations are described. These analysis procedures utilize spherical harmonics basis functions as a means of interpolation between the thirteen discrete radiance observations. An analysis procedure used to infer the direct component of the solar configuration selected upon the the basis of satisfying the analytical procedures,

sampling a 2 pi steradian field of view and minimizing sensor overlap, is given. GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N80-30996 Oklahoma Univ., Norman.
AN INVESTIGATION OF SATELLITE-RADAR CORRELATION FUNCTIONS Ph.D. Thesis
Louis Arthur Hembree, Jr. 1980 210 p
Avail: Univ. Microfilms Order No. 8018924

A multivariate optimal interpolation objective analysis which combines satellite, radar, and gage data to give improved results in estimating surface rainfall is developed. The problems of combining the radar and satellite data sets through the use of space time correlation fields are discussed. These correlation fields represent the storm structure as implied by the observed data. The correlation fields are modeled using a four dimensional Gaussian damped cosine function whose parameters reflect the storm characteristics. The function fitting also gives an estimate of the noise present in the data. The parameters of the model correlation function can also be used to classify storms with respect to their structural characteristics. The correlations between the satellite data and radar derived rain rates were found to range from an order of 0.2 to 0.53 at the space time lags appropriate to maximizing the correspondence between patterns; consequently, the potential value of using the multivariate objective analysis methodology is established. Dissert. Abstr.

N80-30997# Meteorological Research Inst., Tokyo (Japan).
THE GMS USERS' GUIDE, ISSUE 1
Mar. 1980 111 p
Avail: NTIS HC A06/MF A01

User instructions for the Geophysical Monitoring Satellite (GMS) system are provided. The GMS system consists of GMS spacecraft, Command and Data Acquisition Station, Data Processing Center, Turn Around Ranging Stations, and Tracking and Control Center. T.M.

N80-30998# Meteorology International, Inc., Monterey, Calif.
THE APPLICATION OF MEASURES OF SYNOPTIC SIMILARITY TO THE EVALUATION AND DEVELOPMENT OF ATMOSPHERIC PREDICTION MODELS, TASK 2 Final Report
Manfred M. Holl, Michael J. Cuming, and Barbara A. Hawkins Apr. 1980 51 p refs
(Contract N00228-79-C-0035)
(AD-A086034; MII-M-247; NEPRF-CR-30-02) Avail: NTIS HC A04/MF A01 CSCL 04/2

A method is described for bitcoding meteorological analyses and forecasts in terms of specifying parameters which measure pattern characteristics. By matching the associated bit strings, an absolute measure of the similarity between forecast and analyzed synoptic fields can be obtained. Applications to numerical model verification, evaluation and development are discussed. This report is a supplement to NAVENVPREDRSCHFAC CR 79-01 dated March 1979, Task 1 of same title. GRA

N80-30999# Weather Wing (7th), Scott AFB, Ill.
FORECAST WORKSHEET: A NEW APPROACH Final Report
Thomas L. Rish and Ronald G. Shaw 1 May 1980 22 p refs
(AD-A086151; Rept-WW/TN-80/001) Avail: NTIS HC A02/MF A01 CSCL 04/2

Forecasters are given mixtures of centralized forecasting guidance for various models, techniques, and data bases; valid for varying times or time intervals; and presented in many different ways. But to produce an operationally sound forecast, they must logically assemble the various bits and pieces, resolve all inconsistencies, and visualize the interactive changes that will be taking place in the atmosphere. This report describes the results of a study of worksheets normally used by Air Weather Service units to prepare forecasts. It identifies weaknesses that exist in many worksheets and describes a new worksheet format which provides a more logical step-by-step process for preparing forecasts. GRA

N80-31000# New Mexico State Univ., Las Cruces. Dept. of Electrical and Computer Engineering.
THE DESCRIPTION OF THE ROBIN PROGRAM AND ITS CONVERSION TO THE INTERDATA 7-32 COMPUTER SYSTEM
M. Don Merrill and Donald Elwell May 1980 140 p refs
(Contract DAAD07-76-C-0115; DA Proj. 1P6-65702-D-127)
(AD-A086810; ERADCOM/ASL-CR-80-0115-1) Avail: NTIS HC A07/MF A01 CSCL 09/2

ROBIN (the operational program for computation of upper atmosphere density and other parameters from a passive inflatable falling sphere) was developed for the Air Force Cambridge Research Laboratory by the University of Dayton Research Institute in the 1960's. Its utilization was limited to the Meteorological Rocket Network ranges that had high precision radars and large capacity computers. The development of minicomputers and the deployment of Nike Hercules tracking radars at several Army meteorological rocket sites made it possible to expand the use of the ROBIN sphere to remote locations. The only remaining barrier was the adaptation of the ROBIN program to a minicomputer. This report describes the conversion of the ROBIN-UNIVAC 1108 program used by the Atmospheric Sciences Laboratory at White Sands Missile Range, New Mexico, to the Interdata 7-32 minicomputer. GRA

N80-31001# Army Electronics Research and Development Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
OBJECTIVE QUALITY CONTROL OF ARTILLERY COMPUTER METEOROLOGICAL MESSAGES
Ernest B. Stenmark Apr. 1980 44 p refs
(DA Proj. 1L1-62111-AH-71)
(AD-A086554; ERADCOM/ASL-TR-0055) Avail: NTIS HC A03/MF A01 CSCL 09/2

Artillery computer meteorological (CM) messages are susceptible to having errors introduced into them during preparation at the Meteorological Section, during transmission to the user unit, and during entry into the Fire Direction Center computer. Quality control during preparation of the CM message is largely a manual function and thus subject to human error. At the Fire Direction Center, in the case of the most advanced computerized tactical fire direction control system, TACFIRE, quality control of the CM message is limited to superficial automated checks that relate primarily to message format, not content, and to reliance upon visual screening by the TACFIRE operator before acceptance, storage, and usage of the message. No quality control checks of the contents of the message are made during movement of the CM message from the preparer to the user. This report documents the development of procedures for objectively performing meteorologically consistent quality control checks on the contents of single CM messages that would require only very limited automatic data processing resources to implement at either the preparer or user end, or both, and that would improve upon the validity checks currently implemented in the TACFIRE system. GRA

N80-31002# Naval Postgraduate School, Monterey, Calif.
A CLIMATOLOGICAL STUDY OF THE FORCING OF THE NORTH PACIFIC OCEAN BY SYNOPTIC STORM ACTIVITY M.S. Thesis
Michael Scott Risch Mar. 1980 67 p refs
(AD-A086841) Avail: NTIS HC A04/MF A01 CSCL 04/2

Synoptic storm activity over the North Pacific Ocean is investigated by using a special series of six-hourly surface wind analyses prepared by Fleet Numerical Oceanographic Center (FNOC) covering the period 1969-1978. Temporal variance of the surface wind components at each grid point is 'high pass' filtered, thereby removing all temporal variability except that having time scales less than ten days. Both the total and the filtered wind components were used to calculate the cube of the friction velocity and the wind stress curl. Monthly 'climatologies' are calculated by computing ten-year averages of monthly mean cube of the friction velocity and wind stress curl from total and filtered

wind components for each month of the year. It was found that while climatological maps of cube of the friction velocity calculated from filtered data show spatially coherent patterns that are clearly associated with monthly storm tracks, similar maps of wind stress curl do not show such coherent patterns. Maps of anomalous storm activity, as given by the difference between the monthly value and the climatological value for that month, are also prepared and qualitatively compared to observations of large scale sea surface temperature (SST) anomalies. GRA

N80-31003# Air Force Geophysics Lab., Hanscom AFB, Mass. Meteorology Div.

SHORTRANGE FORECASTING THROUGH EXTRAPOLATION OF SATELLITE IMAGERY PATTERNS. PART 2: TESTING MOTION VECTOR TECHNIQUES Final Report

H. Stuart Muench 10 Dec. 1979 30 p refs

(AF Proj. 6670)

(AD-A086862; AFGL-TR-79-0294; AFGL-ERP-685) Avail: NTIS HC A03/MF A01 CSCL 04/2

An effort is underway at Air Force Geophysics Laboratory to develop automated procedures to make short-range (0-6 hr) terminal weather forecasts using GOES imagery data. A simple approach is to extrapolate the cloud patterns using motion vectors derived from a comparison of successive images. This report describes a test of candidate motion vector techniques using twelve cases of six successive images in a variety of weather conditions. Included in the techniques were two that track brightness centers, three that use cross-covariance, and two using winds aloft. All were compared against persistence (no motion, no change). For all time periods and all thresholds, a binary covariance technique had the highest scores but the techniques using winds aloft were very close. Also, no technique was much better than persistence. There is evidence that most (perhaps 75 percent) of the total changes occurring are not due to simple motion of the cloud patterns but due to more complex processes. GRA

N80-31004# Naval Research Lab., Washington, D. C.

PLANETARY BOUNDARY LAYER PARAMETERIZATION FOR TROPICAL CYCLONES BASED ON GENERALIZED SIMILARITY THEORY

Simon Wei-Jen Chang and Rangarao V. Madala 20 May 1980 35 p refs

(ZF52551001)

(AD-A086781; AD-E000460; NRL-MR-4235) Avail: NTIS HC A03/MF A01 CSCL 04/2

A planetary boundary layer (PBL) parameterization based on the generalized similarity theory (GST) was developed for tropical cyclone models. This parameterization, with only one layer, is necessary in modeling tropical cyclones for computational speed. The momentum, sensible heat and moisture fluxes are mutually dependent in this parameterization through nondimensional gradient equations. The internal structure of the PBL is determined implicitly through universal functions. In comparison with a complex, one dimensional, multiyear PBL model, the GST parameterization yields accurate moisture fluxes, but slightly overestimates the momentum flux and underestimates the sensible heat flux. The GST parameterization produces very realistic dynamics, energetics and thermal structure in an axisymmetric tropical cyclone model. This GST parameterization is judged superior to drag coefficient parameterization and is a good alternative to the more expensive, multilayer parameterization. GRA

N80-31005# Air Force Geophysics Lab., Hanscom AFB, Mass. Aeronomy Div.

OPTICAL TURBULENCE FORECASTING: A TUTORIAL Environment Research Paper

Edmond M. Dewan 22 Jan. 1980 69 p refs

(AF Proj. 6687)

(AD-A086863; AFGL-TR-80-0030; AFGL-ERP-694) Avail: NTIS HC A04/MF A01 CSCL 04/1

This report is a tutorial on the effects of atmospheric turbulence upon systems which rely upon the propagation of laser beams. In addition to providing a simplified presentation of turbulence theory and optical effects, it describes the state of the art of the new technique of radiosonde estimation of index of refraction fluctuations. Suggestions are given for future research which will help to answer current Air Force needs. The feasibility of some laser systems will depend upon the value of r sub o, the coherence length (which is related to C sub n sq which in turn is related to the degree of turbulence). At present, the statistics of r sub o are inadequate. GRA

N80-31006# National Center for Atmospheric Research, Boulder, Colo.

AEROSOLS AND CLIMATE

William W. Kellogg 1980 18 p refs Presented at the Intern. Workshop on the Energy/Climate Interactions, Munster, West Germany, 3 Mar. 1980 Prepared in cooperation with the Aspen Inst. for Humanistic Studies, Boulder, Colo.

(Contract DE-AC02-79EV-10281)

(CONF-800309-5) Avail: NTIS HC A02/MF A01

The atmospheric burden of particles, or aerosols, produced by human activities, especially in industrialized regions and those where slash-burn agricultural practices are followed, are discussed. Sources of aerosols discussed include burning of fossil fuels or other materials, photochemical reactions involving organic molecules, oxides of nitrogen, and sunlight, and the oxidation of sulfur dioxide, produced when sulfur-bearing fuel is burned, to sulfuric acid thereby forming sulfate particles or droplets. Emphasis is placed on the way in which the aerosols influence the atmospheric heat balance. DOE

N80-31007# Aspen Inst. for Humanistic Studies, Boulder, Colo.

CONSEQUENCES OF A HYPOTHETICAL WORLD CLIMATE CHANGE PRODUCED BY INCREASED ATMOSPHERIC CARBON DIOXIDE Progress Report, 1 Sep. 1979 - 31 Apr. 1980

Walter Orr Roberts May 1980 8 p

(Contract DE-AC02-79EV-10281)

(DOE/EV-10281/1) Avail: NTIS HC A02/MF A01

Progress is reported on a research program seeking to understand the effects of increased global levels of atmospheric CO2 as a result of human activities. An outline of the major social, economic, geopolitical and ethical issues to be faced as a result of global warming is being attempted. Groundwork is being laid for a longer term effort to delineate possible strategies to meet the predicted challenges. Author (DOE)

N80-31008# Cologne Univ. (West Germany). Inst. fuer Geophysik und Meteorologie.

PRECIPITATION ESTIMATIONS FROM SATELLITE MEASUREMENTS OF HEAT RADIATION AT 19.35 AND 37 GHz [NIEDERSCHLAGSRATEN AUS SATELLITENMESSUNGEN DER WAERMESTRAHLUNG BEI 19.35 UND 37 GHZ]

H. J. Jung Jun. 1979 125 p refs In GERMAN

(Contract DFG-195/17)

(Mitt-26) Avail: NTIS HC A06/MF A01

A method to measure rain rates (0,1 to 50 mm/hr) from satellites (Nimbus 5/6) at 19,35 GHz and at 37 GHz was developed. The calculation of radiation transfer for polarized and unpolarized radiation is utilized. In the spectrum field the radiation transfer is observed for different values of the absorption in gas (H2O and O2), of the extinction in hydrometers (clouds, raindrops, hail and ice particles) and of the emission and reflection possibilities on the ground and water surface. A study of 2 hurricanes shows that it is possible to give a rain rate independent from cloud type and precipitation type. The accuracy of the determination is of 30-40% for rain rates between 0.1 and 7 mm/hr and of 30-100% for rain rates superior to 7 mm/hr. Author (ESA)

N80-31009# World Meteorological Organization, Geneva (Switzerland).

PARAMETERIZATION OF EXTENDED CLOUDINESS AND RADIATION FOR CLIMATE MODELS Global Atmospheric Research Programme

1979 158 p refs Prepared in cooperation with International Council of Scientific Unions, Rome (Italy)

Avail: NTIS HC A08/MF A01

The following topics were deliberated: sensitivity of climate to cloud, cloud prediction and parameterization, mechanisms of cloud formation, observational programs, effect of aerosols, and cloud climatology. The panel recommended that a global cloud climatological data set be developed from existing observations,

that sensitivity and diagnostic studies be carried out to test the dependence of climate on cloudiness, that a set of field observational programs for the improvement of cloud parameterization in climate models be developed to investigate the microphysics of extended cloud formation and the bulk radiative properties of clouds as a function of cloud type. Author (ESA)

N80-31010# World Meteorological Organization, Geneva (Switzerland).
PLAN AND BASIS OF THE WORLD CLIMATOLOGY PROGRAM, 1980 TO 1983 [PLAN ET BASE DU PROGRAMME CLIMATOLOGIQUE MONDIALE, 1980 A 1983]
1979 76 p In FRENCH
(WMO-540; ISBN-9-263-20540-X) Avail: NTIS HC A05/MF A01

The following elements of the program are described: Climatological data and climatological applications are described. Other topics include climatic influences and world climate research. Author (ESA)

N80-31011# World Meteorological Organization, Geneva (Switzerland).
THE 8TH GARP PLANNING MEETING FOR THE MONSOON EXPERIMENT (MONEX) Global Atmospheric Research Programme
1979 93 p refs Meeting held in Singapore, 5-9 Nov. 1979 Prepared in cooperation with International Council of Scientific Unions, Rome (Italy)
(GARP-Spec-34) Avail: NTIS HC A05/MF A01

An assessment of the operations and the review and planning for data management activities is presented, following completion of the field phases of the winter and summer components of the Monsoon Experiment (MONEX). The availability and formats of the quick look data are given. Abstracts of papers representing preliminary scientific results are appended. Author (ESA)

N80-31012# World Meteorological Organization, Geneva (Switzerland).
THE 7TH WMO EXECUTIVE COMMITTE INTER-GOVERNMENT PANEL SESSION ON THE FIRST GARP GLOBAL EXPERIMENT Global Atmospheric Research Programme
1979 134 p refs Conf. held at Geneva, Nov. 1979 Prepared in cooperation with International Council of Scientific Unions, Rome (Italy)
(GARP-Spec-35) Avail: NTIS HC A07/MF A01

The performance of the First Garp Global Experiment (FGGE) Composite Observing System, the status of FGGE data management, and implementation of the regional experiments were reviewed. An assessment of data sets collected during the Global Weather Experiment by surface stations ships and buoys, balloons, satellites, and aircraft is presented. Author (ESA)

N80-31013# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
STUDY OF A PULSED COHERENT LIDAR FOR CROSSWIND SENSING
S. F. Clifford, T. R. Lawrence, G. R. Ochs, and T-I. Wang Mar. 1980 53 p refs Sponsored in part by Army Electronics Research and Development Command, White Sands Missile Range
(PB80-181027; NOAA-TM-ERL-WPL-48) Avail: NTIS HC A04/MF A01 CSCL 04B

A work undertaken to assess the validity and impact of particular assumptions made in deriving the system signal to noise ratio (SNR) expression utilized in an investigation of the expected performance of a system for remote wind measurements in the troposphere is documented. The analysis indicates that the independent turbulence assumption strongly overestimated the effects of turbulence, that the quadratic power wave structure function assumption was wholly inadequate, and that neglecting the apodization effects amounted to an SNR overestimation at the range where the lidar is focused. GRA

N80-31014# National Oceanic and Atmospheric Administration, Silver Spring, Md. Air Resources Labs.
THE SOUTH POLE AUTOMATIC CONDENSATION NUCLEI COUNTER: INSTRUMENT DETAILS AND FIVE YEARS OF OBSERVATIONS
Mark E. Murphy and Barry A. Bodhaine Feb. 1980 94 p refs
(PB80-181712; NOAA-TM-ERL-ARL-82; NOAA-B0032B04)
Avail: NTIS HC A05/MF A01 CSCL 04B

An automatic condensation nuclei counter has been operating continuously at the Amundson-Scott South Pole station since 1974 as part of the Geophysical Monitoring for Climatic Change (GMCC) program. This instrument (calibrated by a Pollak nuclei counter standard), with its high sensitivity and fast response, can provide continuous aerosol climatology and identify periods of contamination from local sources. The annual variation of nuclei concentration is apparent and is repeatably consistent over the five year period. Nuclei concentrations occasionally reach values as low as 7/cu cm during the austral winter (April through September), begin to increase near the time of astronomical sunrise, and reach values as high as about 240/cu cm during summer months. GRA

N80-31015# National Environmental Satellite Center, Washington, D. C.
ENVIRONMENTAL SATELLITE IMAGERY JUNE 1979 Key to Meteorological Records Documentation, no. 5.4
Mar. 1980 97 p
(PB80-181852; NOAA-80042201) Avail: NTIS HC A05/MF A01 CSCL 04B

The Key to Meteorological Records Documentation (KMRD) No. 5.4 series is issued monthly to describe current cloud data obtained by NOAA's operational environmental satellites. It contains daily global satellite imagery in condensed form as a guide to data stored in the NOAA archive, and is designed to assist users in selecting data for research and climatological use. GRA

N80-31016# National Oceanic and Atmospheric Administration, Silver Spring, Md. Air Research Labs.
COMPARISON OF ESTIMATED AND OBSERVED VALUES FOR SOLAR RADIATION AT THE SURFACE OF THE AFRICAN CONTINENT
J. K. Nimira Jan. 1980 51 p refs
(Grant NSF ATM-78-15529)
(PB80-180417; NOAA-TM-ERL-ARL-83; NOAA-80041601)
Avail: NTIS HC A04/MF A01 CSCL 04B

Solar radiation fluxes at the surface of the African continent were estimated by three methods. The methods used cloud data derived from satellite measurements, observed sunshine hour data, and data on several other parameters measured at 57 ground stations throughout Africa. The estimated values were then compared with actual observed global solar radiation values from 10 selected stations. The percentage deviation between estimated and observed values was generally less than plus or minus 15%. GRA

N80-31017# National Technical Information Service, Springfield, Va.
CLOUD SEEDING. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1976 - May 1980
Robena J. Brown Jun. 1980 141 p Supersedes NTIS/PS-79/0575; NTIS/PS-78/0523
(PB80-811037; NTIS/PS-79/0575; NTIS/PS-78/0523)
Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 04B

The bibliography is divided into two sections. The first covers generalized studies on cloud seeding techniques and theory, including environmental and water resources planning studies. The second section presents the results of specific cloud seeding experiments. This updated bibliography contains 132 abstracts, 22 of which are new entries to the previous edition. GRA

N80-31018# National Climatic Center, Asheville, N. C.
SELECTIVE GUIDE TO CLIMATIC DATA SOURCES Key to Meteorological Records Documentation.
Keith D. Butson and Warren L. Hatch Dec. 1979 157 p Sponsored by NOAA
(PB80-187354; KMRD-4.11; NOAA-80050101) Avail: NTIS HC A08/MF A01 CSCL 04B

This guide is arranged to indicate the publication(s) in which these data in their various climatological categories (temperature, precipitation, wind, atmospheric pressure, humidity, etc.), both surface and upper air, may be found. A brief review of the pertinent historical facts associated with each publication is given

where appropriate. The various climatological tables, charts, and graphs included in each publication are listed, and in many cases abbreviated examples are shown. GRA

N80-31019# Delaware Univ., Newark. Water Resources Center.
THE USE OF THE CLIMATIC WATER BUDGET TO EVALUATE THE VALIDITY OF A PRECIPITATION RECORD
John R. Mather and Clinton M. Rowe, Jr. Aug. 1979 43 p refs Submitted for publication
(Contract DI-14-34-0001-9008)
(PB80-182157; CONTRIB-28; WBO-04877; OWRT-A-040-DEL(5); TR-6) Avail: NTIS HC A03/MF A01 CSCL 04B

From 1927 to 1963 the precipitation recorded at La Porte, Indiana, about 30 miles southeast of the Chicago-Gary industrial complex was significantly higher than the precipitation found at any nearby station. Two reasons were suggested for this anomaly. The first assumes that the record is correct and suggests that industrial pollution has resulted in increased downwind precipitation amounts. The second assumes that the record is incorrect and is merely the result of instrumental or observer error. The use of the climatic water budget to determine the more likely conclusion is described. Values of runoff were computed from climatic data from La Porte as well as from South Bend, and Plymouth, Indiana, the stations nearest to LaPorte. GRA

N80-31020# Colorado State Univ., Fort Collins. Dept. of Atmosphere Science.
GATE PHASE 3 MEAN SYNOPTIC-SCALE RADIATIVE CONVERGENCE PROFILES
Steven A. Ackerman and Stephen K. Cox Apr. 1980 135 p refs Sponsored in part by NOAA
(Grants NSF ATM-78-05743; NSF ATM-78-12631)
(PB80-180797; AS-PAPER-324; ISSN-0067-0340) Avail: NTIS HC A07/MF A01 CSCL 04B

Tropospheric radiative convergence profiles are derived for an easterly wave composite during Phase 3 of the GATE. The easterly waves observed were generally well developed. The profiles also represent the magnitude and the spatial distribution of the Intertropical Convergence Zone (ITCZ) in the GATE area. The 12 hour mean daytime and nighttime profiles are presented. Cloud top pressure distributions, as a function of wave position, are also presented. Day-night differences in the cloud top pressure distributions and radiative convergence profiles are discussed. GRA

N80-31021# National Oceanic and Atmospheric Administration, Washington, D. C. Federal Coordinator for Meteorological Services.
NATIONAL SEVERE LOCAL STORMS OPERATIONS PLAN
Mar. 1980 48 p
(PB80-187352; FCM-80-1; NOAA-80040403) Avail: NTIS HC A03/MF A01 CSCL 04B

The thirteenth of an annual series of National Severe Local Storms Operations Plans that was developed after a 1967 request by the Federal Coordinator for Meteorological Service and Supporting Research is presented. This plan outlines the responsibilities of the various United States agencies which provide meteorological services in observing and forecasting severe local storms. GRA

N80-31022# National Center for Atmospheric Research, Boulder, Colo.
PROJECT PHOENIX. THE SEPTEMBER 1978 FIELD OPERATION
W. H. Hooke, ed. Dec. 1979 294 p refs Sponsored by NSF
(PB80-180433; BOA-1; NOAA-80041603) Avail: NTIS HC A13/MF A01 CSCL 04B

The instruments tested and compared and equipment used during Project PHOENIX, a major field study of the planetary boundary layer are described. The data gathering systems evaluated include multiple Doppler radar, microwave radiometer, FM-CW radar, TPQ-11 radar, lidar, optical wind sensors, the Portable Automated Mesonet, rawinsonde, microbarograph, acoustic sounders, balloons, aircraft, and the 300 m BAO tower. Also provided are a discussion of the project's background and planning, a description of the synoptic weather situation during the experiment, instructions for access to the data, and a daily summary log of PHOENIX operations. GRA

N80-31023# Water and Power Resources Service, Denver, Colo. Office of Atmospheric Resources Management.
THE SIERRA COOPERATIVE PILOT PROJECT. PRECIPITATION MANAGEMENT RESEARCH IN THE SIERRA NEVADA Status Report
Dec. 1979 66 p
(PB80-182389) Avail: NTIS HC A04/MF A01 CSCL 04B

The research, design, environmental, and public involvement activities of the Sierra Cooperative Pilot Project are reported. The technical feasibility and social acceptability of cloud seeding in the Sierra Nevada to supplement the region's water supply is addressed. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N80-31024 California Univ., San Diego, La Jolla.
MODELS OF THE EQUATORIAL OCEAN CIRCULATION Ph.D. Thesis
Michael James McPhaden 1980 121 p
Avail: Univ. Microfilms Order No. 8018789

The steady circulation is examined using a linear equatorial beta plane formulation in which continuous density stratification is a key element. The basin is horizontally unbounded and forced by either winds or a surface temperature boundary conditions. Two vertically diffusive models are proposed to examine the effects of different turbulence parameterizations. One is characterized by temperature dissipation proportional to temperature itself, the other has biharmonic friction proportional to a fourth derivative of velocity. Both lead to equations for the steady state that are in many ways analogous to the well known equations governing equatorial wave motion. The analogies are exploited both in obtaining analytical solution and in describing the flow dynamics. Dissert. Abstr.

N80-31025# Washington Univ., Seattle. Applied Physics Lab.
LONG-TERM MEASUREMENT OF ABYSSAL CURRENTS IN THE NORTH PACIFIC Final Report, 1 Jul. 1973 - 30 Sep. 1979
Bruce A. Taft 10 Jan. 1980 33 p refs
(Contract EY-76-S-06-2225)
(DOE/EV-71030/1; RLO-2225-TA-30) Avail: NTIS HC A03/MF A01

Current measurements were made over a 19 month period in the deep Pacific in a region centered at 30 deg 30 min N, 158 deg W. Current meters were moored at 100 and 1100 m off the bottom in two arrays of six moorings. Each mooring had a meter at 100 m above the bottom, and two moorings included an additional meter at the 1100 m level. Most records showed higher eddy kinetic energies than the mean kinetic energy. The time space average eddy kinetic energy is compatible to the lowest values yet measured in the western North Atlantic. The mean vector speed varied from 0.4 to 3.6 cm/s; the directions were variable and showed little consistency. Spectral peaks occurred at the two semidiurnal tidal frequencies M2 and S2 and at the diurnal/inertial frequency. In the low frequency band, there were energetic periods near 70 and 150 days as well as periods that were longer than the period of measurement. The M2 semidiurnal tidal currents were coherent and appear to be consistent with a position of M2 amphidrome at 25 N, 135 W. DOE

N80-31026# Science Applications, Inc., Raleigh, N.C.
SOUTH ATLANTIC OCS PHYSICAL OCEANOGRAPHY, VOLUME 2 Final Report
Mar. 1980 348 p refs
(Contract DI-AA550-CT7-29)
(PB80-181555; BLM/YM/ES-80/2) Avail: NTIS HC A15/MF A01 CSCL 08C

The results of the first year of a four year physical oceano-

graphic and meteorological data collection effort on the Outer Continental Shelf (OCS) from Cape Hatteras, North Carolina to Cape Canaveral, Florida, during the period of September 1977 through November 1978 are presented. Currents, circulation and mixing processes in the Georgia Embayment/South Atlantic Bight (SAB) are studied to assess the effects of CCS oil and gas activities on the biological environment, as well as on recreational and commercial fishing. GRA

N80-31027# Science Applications, Inc., Raleigh, N.C.
SOUTH ATLANTIC OCS PHYSICAL OCEANOGRAPHY, VOLUME 3 Final Report
Mar. 1980 638 p Original contains color illustrations
(Contract DI-AA550-CT7-29)
(PB80-181563; BLM/YM/ES-80/3-Vol-3) Avail: NTIS HC A99/MF A01 CSCL 08J

The complete sets of Data Products resulting from the short-term and long-term current meter mooring data, hydrographic sampling, and meteorology/sea state observations are presented. Ship tracks and sampling plans followed on each cruise are included along with cross-shelf sections and spatial distribution of hydrographic variables. J.M.S.

N80-31028# Instituto del Mar del Peru, Callao.
COASTAL UPWELLING ECOSYSTEMS ANALYSIS. DATA REPORT: CRUISE B/1, SNP-1, 7604 Data Report, 24-25 Apr. 1976
O. Guillen, R. Calienes, and N. Ochoa Jul. 1979 114 p refs In ENGLISH and SPANISH Sponsored by NSF
(PB80-132921; NSF/IDOE/CUEA/DR-62; NSF/IDOE-79-130) Avail: NTIS HC A06/MF A01 CSCL 08J

Physical chemical and biological bottle data are presented in tabular form and in horizontal and vertical displays. The data represent Cruise B/1, SNP-1, 7604, April 24-28, 1976. The area covered was between Pisco and Callao in the equatorial region of the Pacific Ocean. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N80-31029 Iowa State Univ. of Science and Technology, Ames.
A PARABOLOIDAL FLOW CYTOMETER FOR IMPROVED FLUORESCENCE ANALYSIS OF SINGLE CELLS Ph.D. Thesis
Mary Jane Skogen Hagenson 1980 161 p
Avail: Univ. Microfilms Order No. 8019634

A flow cytometer featuring a paraboloidal flow chamber for optical collection was designed to improve fluorescence analysis of single cells. The improvement is achieved by increasing the fluorescence collection efficiency permitting measurement of weakly fluorescent particles and by improving fluorescent intensity resolution, thereby making it possible to differentiate cells with smaller differences in fluorescence intensity. The paraboloidal flow system was evaluated with standard spheres, mouse testicular cells and nuclei, and weakly fluorescent cells. It was demonstrated that the paraboloid; (1) improves fluorescence intensity resolution relative to orthogonal systems by nearly 20% for standard particles and round spermatid nuclei; (2) increases the fluorescence signal to noise ratio, allowing measurement of fluorescence which was not resolved from background noise in orthogonal systems; and (3) is relatively insensitive to particle orientation with respect to illumination and collection optics. Dissert. Abstr.

N80-31030*# California Univ., Davis. Dept. of Animal Physiology.
THERMOREGULATION IN RATS: EFFECTS OF VARYING DURATION OF HYPERGRAVIC FIELDS Annual Report, 1 Jul. 1979 - 31 Aug. 1980
J. M. Horowitz and B. A. Horwitz Aug. 1980 28 p refs
(Grant NsG-2234)
(NASA-CR-163481) Avail: NTIS HC A03/MF A01 CSCL 06C

The effects of hypergravitational fields on the thermoregulatory system of the rat are examined. The question underlying the investigation was whether the response of the rat to the one hour cold exposure depends only upon the amplitude of the hypergravic field during the period of cold exposure or whether the response is also dependent on the amplitude and duration of the hypergravic field prior to cold exposure. One hour of cold exposure applied over the last hour of either a 1, 4, 7, 13, 19, 25, or 37 hr period of 3G evoked a decrease in core temperature (T sub c) of about 3 C. However, when rats were subjected concurrently to cold and acceleration following 8 days at 3G, they exhibited a smaller fall in T sub c, suggesting partial recovery of the acceleration induced impairment of temperature regulation. In another series of experiments, the gravitational field profile was changed in amplitude in 3 different ways. Despite the different gravitational field profiles used prior to cold, the magnitude of the fall in T sub c over the 1 hr period of cold exposure was the same in all cases. These results suggest that the thermoregulatory impairment has a rapid onset, is a manifestation of an ongoing effect of hypergravity, and is not dependent upon the prior G profile. M.G.

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation, and weightlessness.

N80-31031 California Univ., Davis.
THE EFFECT OF PHYSICAL CONDITIONING ON +Gz TOLERANCE Ph.D. Thesis
William Lewis Epperson 1980 86 p
Avail: Univ. Microfilms Order No. 8018968

The influence of physical conditioning on tolerance to a centrifugation profile of alternating 15 second plateaus at 4.5 and 7.0 +Gz--called Simulated Aerial Combat Maneuvering (SACM)--was determined using 24 young men as subjects. These subjects were assigned to groups as controls (C) (no physical training), runners (R), and weight trainers (W); and followed a 12 week protocol of specified physical training. Tolerance to centrifugation, maximum oxygen consumption, muscle strength, and body composition were periodically determined. The +Gz tolerance of the runners and controls increased at an average rate of 4 seconds per week during the course of the experiment. The weight trainers increased their G tolerance at an average rate of 15 seconds per week. Fatigue scores indicate that group W subjects take longer to reach a given level of fatigue than did the subjects of the other groups. It appears therefore that a physical conditioning program of weight training will improve human tolerance to repeated and prolonged exposure to high +Gz loads. Dissert. Abstr.

N80-31032 Drexel Univ., Philadelphia, Pa.
AN INVESTIGATION OF CARDIAC THRESHOLD VARIABILITY RELATIVE TO STIMULUS SHAPE AND RESPIRATORY CYCLE Ph.D. Thesis
Leonid Hrebien 1980 168 p
Avail: Univ. Microfilms Order No. 8019351

To study threshold relative to stimulus shape, energy strength duration relationships were determined for three different stimulating waveforms: the standard rectangular, the sawtooth (ramp), and the exponential. Stimulus threshold energies were determined at pulse durations ranging from 0.4 to 3.0 milliseconds for each waveform and the results were plotted as energy strength duration curves. It was found that threshold energy requirements for sawtooth stimuli were 3-27% lower than for standard rectangular stimuli at the same pulse widths. Also, exponential stimuli showed energy reductions of 2-30% from the rectangular stimuli. Threshold determinations were made once a minute for 20 to 30 minutes using rectangular pulses, 1 millisecond in duration. It was found that threshold energies varied as much as 37% above the mean to 19% below the mean value for the 20-30 minute run of the experiment. It was found that during certain portions of the respiration cycle pacemaker pulses of a given amplitude would elicit cardiac response whereas these same pulses failed to pace during other phases of the breathing cycle. Dissert. Abstr.

N80-31033 California Univ., San Diego, La Jolla.
TOPOGRAPHICAL SIMULATION OF THE BLOOD VESSELS OF THE HUMAN BULBAR CONJUNCTIVA AND APPLICATION TO PRESSURE-FLOW RELATIONSHIPS Ph.D. Thesis
Bruce Miles Fenton 1980 175 p
Avail: Univ. Microfilms Order No. 8018778

A preliminary study was performed in which length of conjunctival vessels per unit area tissue (vascular density) was measured for two categories of patients: diabetics and nondiabetics. It was assumed that the conjunctiva represents a nonspecialized tissue whose microcirculatory network, in the presence of chronic disease, in some way reflects a generalized trend manifest to a varying degree in other vascular beds. Specifically, it was demonstrated that there were significant differences in length per unit area values between diabetic and nondiabetic cohorts. In addition, age was seen to exert a dramatic influence on overall vascularity. In order to more fully explore the influence of these quantitative variations on blood-tissue exchange properties of the system, a much more detailed type of analysis was required, namely a complete topographical mapping of the conjunctival vasculature. By applying an approach developed by the geomorphological sciences, it was shown that changes in vessel lengths, numbers, and diameters could be related to order number by applying three basic mathematical relationships.
Dissert. Abstr.

N80-31034 Carnegie-Mellon Univ., Pittsburgh, Pa.
ANALYSIS OF HUMAN AUDITORY BRAINSTEM RESPONSES FOR COMPLEX STIMULI Ph.D. Thesis
Paul Joseph Ainslie 1980 207 p
Avail: Univ. Microfilms Order No. 8020148

The results of the application of an analysis technique to separate responses of the auditory brainstem responses (ABRS) are reported for three types of complex click stimuli: monaural clicks with contralateral masking noise, monaural click trains of 1 to 4 clicks with interclick times of 2 to 61.5 msec, and binaural clicks with interaural time delays of 0 to 7 msec of interaural intensity differences of 0 to 30 dB. Responses recorded for monaural clicks without and with contralateral broadband masking noise were combined to estimate a masking effect waveform. The derived waveform resembled an ABR for direct monaural stimulation at 35 dB lower stimulus magnitude. Control experiments showed this derived masking effect waveform to be due to acoustic crosstalk evoking an ABR in the ear contralateral to the monaurally stimulated ear. Responses for monaural click train stimuli were analyzed by deriving a waveform estimating the response to each click of the click train. These derived responses showed little change after the response to the third click. Responses to binaural stimuli were obtained and compared to the sum of the responses for the constituent monaural stimuli.
Dissert. Abstr.

N80-31035# National Technical Information Service, Springfield, Va.
COLD WEATHER STRESS ON HUMANS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - May 1980
Elizabeth A. Harrison Jun. 1980 152 p Supersedes NTIS/PS-79/0589; NTIS/PS-78/0540
(PB80-810989; NTIS/PS-79/0589; NTIS/PS-78/0540) Avail: NTIS HC $30.00/MF $30.00 CSCL 06S

The selected abstracts cover cold stress, cold tolerance, cold injuries, acclimatization, protective clothing, and cold water exposure as related to cold weather stress on humans. This updated bibliography contains 145 abstracts, 5 of which are new entries to the previous edition.
GRA

N80-31036# National Institutes of Health, Bethesda, Md. Lab. of Neurobiology.
INTRODUCTION TO ELECTROCHEMISTRY OF NERVE MEMBRANES
Ichiji Tasaki Mar. 1980 695 p refs
(PB80-178908; NIMH-80/03) Avail: NTIS HC A99/MF A01 CSCL 06F

The evolution of physiology of nerve fibers is linked closely with that of electrochemistry. Experimental facts known at the present time are described and interpreted on the basis of present level of understanding of morphology, biochemistry and physical chemistry. Old theories are also discussed in detail for the experimental basis of those theories are still meaningful. The volume is written primarily for students of biology and medicine who are interested in the properties of nerve fibers.
GRA

N80-31037# National Technical Information Service, Springfield, Va.
ULTRASONICS IN MEDICINE. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - May 1980
Elizabeth A. Harrison Jun. 1980 157 p Supersedes NTIS/PS-79/0563; NTIS/PS-78/0494
(PB80-810922; NTIS/PS-79/0563; NTIS/PS-78/0494) Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 06E

The bibliography presents citations from Federally funded research on the use of ultrasound in diagnosis and therapy. Information is presented on ultrasonic imaging techniques, echoencephalography, echocardiography, use of ultrasound in bone surgery, and ultrasonic instrumentation. This updated bibliography contains 150 abstracts, 25 of which are new entries to the previous edition.
GRA

N80-31038# National Technical Information Service, Springfield, Va.
ULTRASONICS IN MEDICINE. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, Apr. 1978 - May 1980
Elizabeth A. Harrison Jun. 1980 257 p Supersedes NTIS/PS-79/0565; NTIS/PS-78/0495
(PB80-810930; NTIS/PS-79/0565; NTIS/PS-78/0495) Avail: NTIS HC $30.00/MF $30.00 CSCL 06E

Research reports on the applications of ultrasound to diagnosis and therapy are cited from worldwide literature. Information is presented on ultrasonic imaging techniques, ultrasonic echoencephalography, echocardiography, use of ultrasound in surgery, and ultrasonic instrumentation in biomedical measurement. This updated bibliography contains 250 abstracts, 137 of which are new entries to the previous edition.
GRA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N80-31039*# Behavioral Research Applications Group, Inc., Rochester, N. Y.
INSTRUMENT SCANNING AND CONTROLLING: USING EYE MOVEMENT DATA TO UNDERSTAND PILOT BEHAVIOR AND STRATEGIES Final Report
A. O. Dick Washington, D.C. NASA Sep. 1980 89 p refs (Contract NAS1-14793)
(NASA-CR-3306; BRAG-TR-79-2) Avail: NTIS HC A05/MF A01 CSCL 05I

Eye movement data and other parameters including instrument readings, aircraft state and position variables, and control maneuvers were recorded while pilots flew ILS simulations in a B 737. The experiment itself employed seven airline pilots, each of whom flew approximately 40 approach/landing sequences. The simulator was equipped with a night visual scene but the scene was fogged out down to approximately 60 meters (200 ft). The instrument scanning appeared to follow aircraft parameters not physical position of instruments. One important implication of the results is: pilots look for categories or packets of information. Control inputs were tabulated according to throttle, wheel position, column, and pitch trim changes. Three seconds of eye movements before and after the control input were then obtained. Analysis of the eye movement data for the controlling periods showed clear patterns. The results suggest a set of miniscan patterns which are used according to the specific details of the situation. A model is developed which integrates scanning and controlling. Differentiations are made between monitoring and controlling scans.
R.K.G.

N80-31040# Army Natick Research and Development Command, Mass. Clothing Equipment and Materials Engineering Lab.
THE PSYCHOMOTOR PERFORMANCE OF MEN AND

WOMEN WEARING TWO TYPES OF BODY ARMOR
Carolyn K. Bensel, Darrell S. Fink, and Sirvart A. Mallian Mar. 1980 115 p refs
(DA Proj. 1L1-62723-AH-98; DA Proj. 1G4-64713-DL-42)
(AD-A086742; NATICK/CEMEL-195; NATICK/TR-80/014)
Avail: NTIS HC A06/MF A01 CSCL 19/4

This study was conducted to determine the effects of load carrying equipment (LCE) and two types of fragmentation protective armor vests, Standard B Fragmentation Protective Body Armor (STD B) and the Personnel Armor System for Ground Troops (PASGT), on body flexibility, rate of movement, psychomotor coordination, manual dexterity, and effort exerted for task performance. Twelve men and twelve women, outfitted in utilities, performed the battery of 16 tasks under each of the following clothing conditions: utilities alone, STD B armor, PASGT armor, LCE, STD B armor - LCE, and PASGT armor - LCE. In general, performance levels were highest when the utilities were worn without any additional items and lowest when the STD B vest was worn in conjunction with the LCE. The STD B armor impaired certain aspects of psychomotor performance, particularly body flexibility, to a greater extent than the PASGT vest did. The collar and shoulder designs seemed to be the critical features responsible for the superior performance achieved with the PASGT vest. After the data had been transformed to remove effects accounted for by difference in the basic capabilities of men and women, two tasks which required arm movements were found to be significantly affected by the sex variable. The women's performance of these movements was impaired relative to the men's because of the excessive length of the armor across the women's shoulders. GRA

N80-31041# Honeywell Systems and Research Center, Minneapolis, Minn.
HUMAN OPERATOR INTERFACE WITH FLIR DISPLAYS Final Report, Jun. 1977 - Sep. 1979
Larry G. Goble, L. G. Williams, P. D. Pratt, J. Wald, G. Rubin, and T. Hanson Wright-Patterson AFB, Ohio AMRL Mar. 1980 251 p refs
(AD-A086284; Doc-79SRC54; AMRL-TR-79-114) Avail: NTIS HC A12/MF A01 CSCL 17/5

This report presents an extensive review of factors which limit performance of forward-looking infrared (FLIR) systems. Two critical variables of system performance, modulation transfer function (MTF) and noise equivalent delta temperature (NE delta T), were chosen for further experimental analysis. The experiment used a digital simulation of minimum resolvable temperature (MRT) paradigm to test two modeled FLIR systems. Detection and recognition data were collected for two targets (four-bar and square) in trials with varying levels of size, contrast, noise, and MTF. The test results were compared with the NVL predictive model(Ratches, et al., 1975) used to evaluate FLIR system performance. GRA

N80-31042# Illinois Univ. at Urbana-Champaign, Champaign. Engineering-Psychology Research Lab.
AN INVESTIGATION OF THE DUAL TASK PERFORMANCE RELATIONSHIP TO HEMISPHERIC SPECIALIZATION Interim Report
Christopher D. Wickens and Diane Lynn Sandry Jun. 1980 41 p refs
(Contract N00014-79-C-0658; NR Proj. 196-158)
(AD-A086808; EPL-80-1/ONR-80-1) Avail: NTIS HC A03/MF A01 CSCL 05/10

The efficiency of dual task performance may be influenced by a number of variables such as the level of practice of the individual, the difficulty of the task, and the particular processing resources or capacities for which the two tasks compete. The current research investigates the relation between the capacities employed in two tasks--a verbal processing resource inferred to reside in the left cerebral hemisphere, and a spatial resource in the right--and the controlling hand. Specifically a condition of task-hemispheric integrity is defined when the processing and responding of each task is carried out in a single cerebral hemisphere. In the experiment, this condition occurs when a tracking task, inferred to be spatial right-hemispheric in its processing is controlled with the left hand, while a Sternberg memory search Reaction Time task with the letter stimuli, inferred to be verbal left-hemispheric, is responded to with the right hand. A 'mixture' condition is created with the opposite hand assignment, so that each hemisphere processes the information associated with one task, while responding to the other (i.e., Sternberg Task-left hand, Tracking-right). GRA

N80-31043# Illinois Univ. at Urbana-Champaign, Champaign. Dept. of Psychology.
DIFFERENTIALLY WEIGHTING LINEAR MODELS OF BEHAVIOR: AN EMPIRICAL COMPARISON OF SIX METHODS
Charles K. Parsons (Georgia Inst. of Technology, Atlanta) and Charles L. Hulin Jun. 1980 35 p refs Sponsored in part by Illinois National Guard
(Contract N00014-75-C-0904; NR Proj. 170-802)
(AD-A086876; TR-80-4) Avail: NTIS HC A03/MF A01 CSCL 12/1

Six methods of estimating regression weights for a linear model of behavior were compared in 51 samples of National Guardsmen. Ordinary least squares, Bayesian m-group regression, ridge regression, equal weighting, and two related methods were used. Weights were estimated in one-half of each sample and then applied to data in the other half. Ratios of observations to predictors ranged from 4:1 to 19:1. Cross validation R sq was used as the index of model or equation stability. Results support earlier findings that least squares weights are relatively unstable in small samples, but do not indicate the superiority of any one other method. Future research and implications for using these regression techniques in testing behavioral models are discussed. GRA

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N80-31044*# TRW Defense and Space Systems Group, Redondo Beach, Calif. Systems Engineering and Analysis Dept.
ADVANCED FLIGHT DESIGN SYSTEMS SUBSYSTEM PERFORMANCE MODELS. EXECUTIVE SUMMARY
K. C. Parker and J. G. Torian Jun. 1980 17 p
(Contract NAS9-15793)
(NASA-CR-160768; TRW-34902-H001-R0-00) Avail: NTIS HC A02/MF A01 CSCL 06K

Subsystem performance analysis required in flight design to assess the capability of the environmental control and life support system (ECLSS) to support the flight requirements and define operational procedures under contingency flight conditions is described. Current ECLSS modeling techniques are limited in the variety of configurations and they employ batch mode computer programs execution methods. Improvements in the variety of configurations that are modeled and a reduction in effort required for modeling and analysis is accomplished by developing a modular computer program which operates interactively. T.M.

N80-31045*# TRW Defense and Space Systems Group, Redondo Beach, Calif. Systems Engineering and Analysis Dept.
ADVANCED FLIGHT DESIGN SYSTEMS SUBSYSTEM PERFORMANCE MODELS. USER GUIDE: ENVIRONMENTAL ANALYSIS ROUTINE LIBRARY
K. C. Parker and J. G. Torian Jun. 1980 138 p refs
(Contract NAS9-15793)
(NASA-CR-160769; TRW-34902-H002-R0-00) Avail: NTIS HC A07/MF A01 CSCL 06K

A user guide for a library of interactive computer routines used to develop performance analysis models of specific environmental control and life support subsystems is presented. T.M.

N80-31046*# TRW Defense and Space Systems Group, Redondo Beach, Calif. Systems Engineering and Analysis Dept.
ADVANCED FLIGHT DESIGN SYSTEMS SUBSYSTEM PERFORMANCE MODELS. SAMPLE MODEL: ENVIRONMENTAL ANALYSIS ROUTINE LIBRARY

K. C. Parker and J. G. Torian Jun. 1980 40 p
(Contract NAS9-15783)
(NASA-CR-160770; TRW-34902-H003-R0-00) Avail: NTIS HC A03/MF A01 CSCL 06K

A sample environmental control and life support model performance analysis using the environmental analysis routines library is presented. An example of a complete model set up and execution is provided. The particular model was synthesized to utilize all of the component performance routines and most of the program options. T.M.

N80-31047# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
FLAME TESTING OF TWO SAMPLES OF EXPOSURE SUIT MATERIAL Final Report
Frank H. Jacobson 9 May 1980 16 p refs
(WU6065L00)
(AD-A086739; NADC-80097-60) Avail: NTIS HC A02/MF A01 CSCL 11/5

Reported deficiencies in authorized quick-donning ship-abandon type exposure suits has prompted use of other suits made of materials with unknown flame and heat retardant properties. Therefore, tests were requested to be addressed first to the question of flammability of the material, and second to the question of heat retardation by the material. The materials tested may provide better protection against standard 3 second exposures to fuel fires than any fabrics previously tested in this laboratory. However, the protection falls off sharply as the exposure is continued. GRA

N80-31048# Navy Clothing and Textile Research Facility, Natick, Mass.
THERMAL INSULATION MATERIALS FOR DIVER'S UNDERWEAR GARMENT Final Technical Report, 1977 - 1978
Norman F. Audet, George M. Orner, and Zelig Kupferman Feb. 1980 31 p refs Presented at Ann. Winter Meeting of ASME, Ocean Eng. Div., San Francisco, 12-15 Dec. 1978
(TF51523003)
(AD-A086743; NCTRF-139; Rept-2-78) Avail: NTIS HC A03/MF A01 CSCL 06/17

The Navy Clothing and Textile Research Facility (NCTRF) conducted studies on commercially available foam and fibrous thermal insulating materials to determine those which would be effective in a diver's dry-suit underwear garment. An effective insulation had to allow the pressurized gaseous environment existing within the diver's dry suit to permeate the insulation, have good compressional resistance at hydrostatic pressures up to 2 psi (13.8 kPa), and provide an intrinsic thermal insulation value of 1.0 to 1.5 clo. Evaluations of candidate materials and comparisons with existing materials used in diver's dry-suit underwear indicated that a fine pore open cell foam and the polypropylene microfiber batt material having densities of approximately 0.12 gr/c cm and 0.05 gr/c cm and thermal insulation resistance of 1.8 and 2.11 clo/cm at 2 psi (13.8 kPa), respectively, would meet the thermal requirements for the underwear garment and would be superior to those presently being used. The foam compressed less than 30% at 2 psi (13.8 kPa). The fibrous material compressed 60% at 2 psi (13.8 kPa) but had such a high specific clo value incompressed (2.27 clo/cm) that thermal resistance at 2 psi (13.8 kPa) was still estimated to be 2.11 clo/cm. GRA

N80-31049# Los Alamos Scientific Lab., N. Mex.
LASER PROTECTIVE EYEWEAR PROGRAM AT THE LOS ALAMOS SCIENTIFIC LABORATORY
D. C. Winburn 1980 24 p refs Presented at Ind. Hyg. Conf., Houston, Tex., 18-23 May 1980
(Contract W-7405-eng-36)
(LA-UR-80-1038; CONF-800531-1) Avail: NTIS HC A02/MF A01

The proliferation of lasers focused considerable attention on providing adequate eye protection for experimenters involved in the use of a wide variety of nonionizing radiation. Experiments with fast/pulsed lasers (Nd:YAG, HF, and CO2) were performed to gain biological threshold data on ocular damage. In parallel, eye protection devices were evaluated, which resulted in the development of lightweight, comfortable spectacles of colored glass filters that can be ground to prescription specifications. Goggle styles are employed in specific applications. DOE

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

N80-31050 State Univ. of New York at Stony Brook.
THE DESIGN AND IMPLEMENTATION OF A HIERARCHICAL MULTICOMPUTER Ph.D. Thesis
Devesh Bhatt 1980 187 p
Avail: Univ. Microfilms Order No. 8019737

System organization, communication, control, and fault tolerance are in the context of a hierarchical multicomputer. The hardware design of the hierarchical multicomputer is presented. The system is uniformly extensible to a very large number of processors without a significant increase in the complexity of the hardware and software subsystems. Particular attention is paid to the design of the interprocessor links, and the implications of the support required. The issues of task distribution, scheduling, and interprocess communication are addressed. It is noted that considerable simplification can be achieved by dedicating a processor to one user task at a time without much penalty in typical utilization figures. The emphasis is on designing a facility which does not impose any unwanted non-causal synchronization on the client processes. The design of a level structured kernel to implement these functions is presented. Finally, the issues of error detection, localization and confinement, dynamic reconfiguration, recovery, diagnostics, and interactive debugging are addressed. Dissert. Abstr.

N80-31051 Southern Methodist Univ., Dallas, Tex.
A STATEMENT ORIENTED DATA FLOW PROCESSOR Ph.D. Thesis
Robert Wayne Heller 1980 107 p
Avail: Univ. Microfilms Order No. 8019072

A computer architecture is investigated which is based on the separation of programs into three distinct classes of items: data, operations, and control structures incorporating facets from both the classical von Neumann and data flow organizations. The resulting hybrid architecture solves some of the problems inherent in data flow designs, while retaining the parallelism in executions of expressions present in such designs. Furthermore, since the design is based upon the structure of programs, the design has many of the desirable properties of the language directed architectures. Dissert. Abstr.

N80-31052# Maryland Univ. -College Park. Dept. of Chemistry.

A DIGITAL TEMPERATURE CONTROL AND MEASUREMENT SYSTEM
R. B. Strem, B. K. Das, W. T. Angel, J. T. Siewick, S. C. Greer (NBS, Gaithersburg, Md.), and C. T. VanDegrift 4 Jul. 1980 24 p refs Submitted for publication
(Contract N00014-79-C-0008; NR Proj. 051-701)
(AD-A086805; TR-1) Avail: NTIS HC A02/MF A01 CSCL 09/2

An automated digital temperature control and measurement system with a temperature resolution of 0.3 to 3.0 mK and operating in the temperature range -40 C to -79 C is described in this report. GRA

N80-31053# Naval Research Lab., Washington, D. C. Communications Sciences Div.
FUNCTIONAL DESIGN FOR AN AUTOMATED DATA BASE ERROR DETECTION SYSTEM Final Report
Gerald A. Wilson, Sandra B. Salazar, and Kathryn L. Heninger 15 May 1980 87 p refs
(XF21244103)
(AD-A086811; AD-E000448; NRL-MR-4223) Avail: NTIS HC A05/MF A01 CSCL 09/2

This report documents the design proposed for an automated system for data base error detection. The system, called COPE, will be a front end to the data base management system to catch errors before they enter the data base. It will check for errors in each user's updates and prevent errors due to undesirable interactions between users. It should be invisible to the users during normal processing when an error is detected, it will operate interactively to inform the user and to request correction. GRA

N80-31054# Southern Methodist Univ., Dallas, Tex. School of Industrial Engineering.
RANDOM PROCESS GENERATION Final Report, 1 Jun. 1977 - 30 Sep. 1979
Bruce W. Schmeiser Jun. 1980 13 p refs
(Contract N00014-77-C-0425; NR Proj. 277-236)
(AD-A086758) Avail: NTIS HC A02/MF A01 CSCL 09/2

'Random process generation' includes all aspects of modeling and generating (pseudo) random variates for driving probabilistic simulations on digital computers. Topics include the selection of appropriate statistical distributions, parameter determination, diagnostic checking, and generation of random variables. The research performed under the auspices of this contract emphasized the use of general four parameter families of distribution during the first year. The second year concentrated on generation of random vectors from multivariate distributions. Several other topics were considered as well. A brief summary of the principal investigator's thoughts on the future of random process generation concludes the report. GRA

N80-31055# Yale Univ., New Haven, Conn. Dept. of Computer Science.
A SURVEY OF SYNCHRONIZATION PROBLEMS
George Holober Sep. 1980 55 p refs
(Contract N00014-75-C-0752)
(AD-A086509; TR-181/80) Avail: NTIS HC A04/MF A01 CSCL 09/2

Decreased hardware costs will facilitate the use of parallel computation in the near future. Synchronization primitives will be needed to implement concurrent algorithms. Many such primitives have been proposed to date. Unfortunately, their power can only be accurately measured in terms of their ability to solve a particular set of synchronization problems. A correspondingly large number of such problems have been proposed along with the primitives. We present some of these synchronization problems and outline their parameters, variations, and histories. GRA

N80-31056# Wisconsin Univ. - Madison. Mathematics Research Center.
DESIGN CONSIDERATIONS FOR DATA-FLOW DATABASE MACHINES
Haran Boral and David J. DeWitt Mar. 1980 36 p refs
(Contracts DAAG29-79-C-0165; DAAG29-75-C-0024; Grant NSF MCS-78-01721)
(AD-A086374; MRC-TSR-2058) Avail: NTIS HC A03/MF A01 CSCL 09/2

This paper presents a discussion of the application of data-flow machine concepts to the design and implementation of database machines which execute relational algebra queries. We analyze the performance of multiprocessor nested-loops and sort-merge join algorithms and show that the nested-loops algorithm is generally superior. Three levels of operand granularity for data-flow database machines are introduced and compared using the nested-loops join algorithm. We demonstrate that relation-level granularity is too coarse and that tuple-level granularity is too fine. The third level of granularity, a page of a relation, is shown to be the best choice from both hardware and software viewpoints. Finally a preliminary design for a data-flow database machine which utilizes page-level granularity and supports distributed control of instruction execution is presented. GRA

N80-31057# Stanford Univ., Calif. Dept. of Computer Science.
THE COMPUTER MODERN FAMILY OF TYPEFACES
Donald E. Knuth Jan. 1980 210 p Sponsored in part by the NSF, IBM and Xerox Corp.
(Contract N00014-76-C-0330)
(AD-A086359; SU-STAN-CS-80-780) Avail: NTIS HC A10/MF A01 CSCL 09/2

This report gives machine-independent definitions of all the styles of type planned for use in future editions of The Art of Computer Programming. Its main purpose is to provide a detailed example of a complete family of font definitions using METAFONT, so that people who want new symbols for their own books and papers will understand how to incorporate them easily. The fonts are intended to have the same spirit as those used in earlier editions of The Art of Computer Programming, but each character has been redesigned and defined in the METAFONT idiom. It is hoped that some readers will be inspired to make similar definitions of other important families of fonts. The bulk of this report consists of about 400 short METAFONT programs for the various symbols needed, and as such it is pretty boring, but there are some nice illustrations. GRA

N80-31058# Maryland Univ., College Park. Dept. of Computer Science.
REAL-WORLD PROPERTIES IN THE REQUIREMENTS FOR EMBEDDED SYSTEMS
Pamela Zave 1979 17 p refs
(Contract N00014-77-C-0623)
(AD-A086867) Avail: NTIS HC A02/MF A01 CSCL 09/2

This paper addresses a central issue in the specification of requirements for embedded systems: How can the ragged and open-ended properties of the 'real world' be usefully included in a coherent, closed requirements specification. Certainly the term 'embedded system' is closely associated with the physical properties of computing environments, such as time and hardware reliability. Section 2 argues that emphasis on real-world, or physical, properties defines embedded systems, so that the role of these properties in requirements specification for embedded systems is indeed central. Section 3 sketches an approach to the requirements problem which should be well suited to the inclusion of physical attributes, but explains that a nagging problem remains. Section 4 presents a trial solution to this problem.GRA

N80-31059# Doty Associates, Rockville, Md.
HANDBOOK OF PROCEDURES FOR ESTIMATING COMPUTER SYSTEM SIZING AND TIMING PARAMETERS. VOLUME 1: PROCEDURES AND TECHNIQUES Final Technical Report, 16 May 1979 - 15 Feb. 1980
William B. Humphrey and John N. Postak 15 Feb. 1980 157 p refs
(Contract F19628-79-C-0106)
(AD-A086444; DAI-TR-235-Vol-1; ESD-TR-80-115-Vol-1) Avail: NTIS HC A08/MF A01 CSCL 09/2

This first volume of the handbook presents procedures that provide a structured approach for estimating computer system sizing and timing parameters during the acquisition life-cycle of Embedded Computer Systems (ECS). The procedures were designed for use by the Electronic Systems Division's Computer Systems Engineering Directorate (ESD/TOI). Based on engineering discipline, the procedures provide a step-by-step program to assist ESD/TOI engineers and computer scientists in evaluating

or conducting initial sizing and timing estimates, updates, or developmental monitoring. Procedural steps are discussed with emphasis on actions that should be taken, risks that should be considered, constraints that may be encountered, and factors that may affect the quality of the estimate at various stages of the acquisition. Techniques that can be used in estimating sizing and timing parameters are also discussed, including data requirements, assumptions, and levels of confidence. In addition, this volume also contains a reference listing, bibliography, glossary, and an index. GRA

N80-31060# Michigan Univ., Ann Arbor. Dept. of Electrical and Computer Engineering.
NUMERICAL STUDIES IN COMPUTER AIDED DESIGN. PART 2: STUDIES IN HIGH SPEED Final Report
D. A. Calahan 12 May 1980 15 p refs
(Grant AF-AFOSR-2812-75; AF Proj. 2304)
(AD-A087060; AFOSR-80-0546TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

This report summarizes research investigating (1) algorithms for the vectorized direct solution of sparse simultaneous equations, and (2) the application of vector processors to aerodynamic fluid flow. The research was performed between April 1, 1975 and March 31, 1980. GRA

N80-31061# Radian Corp., Houston, Tex.
RADIAN DART MICROCOMPUTER SYSTEM HARDWARE DOCUMENTATION OPERATION SYSTEM DESCRIPTION. DART 2 DOCUMENTATION, VOLUME 3
23 May 1979 131 p
(Contract EY-77-C-02-4596)
(CDO-4596-1-Vol-3) Avail: NTIS HC A07/MF A01

An operator's manual for the DART 2 Acquisition, Reduction, and Transmission system is presented. Topics include system capabilities and configurations; ways in which the microprocessor-based central processing unit communicates with the memory and peripheral devices; theory of operation for the system components; and a section of reference data including schematic diagrams, cable lists, device specification sheets, and other detailed information. DOE

N80-31062# British Aerospace Dynamics Group, Bristol (England). Electronics and Space Systems.
RANDOM ACCESS MEMOMY, VOLUME 1 Final Report
A. J. Legg Aug. 1979 75 p 2 Vol.
(Contract ESTEC-3005/76-NL-HP(SC))
(ESS/SS-935-Vol-1; ESA-CR(P)-1329-Vol-1) Avail: NTIS HC A04/MF A01

The design production, and testing of an engineering model of the highly reliable semiconductor random access memory are discussed. A set of equipment is described including a Texas 990/4 computer, silent 700 terminal, interface unit, console and loom. R.C.T.

N80-31063# British Aerospace Dynamics Group, Bristol (England). Electronics and Space Systems.
RANDOM ACCESS MEMORY, VOLUME 2 Final Report
A. J. Legg Aug. 1979 81 p refs 2 Vol.
(Contract ESTEC-3005/76-NL-HP(SC))
(ESS/SS-935-Vol-2; ESA-CR(P)-1329-Vol-2) Avail: NTIS HC A05/MF A01

An engineering model of highly reliable semiconductor memory was developed, which has a storage capacity of 16K words of 16 bits/word. The method of error correction used to improve reliability is the Single Error and Erasure Correction (SEEC) scheme. Modular packaging was used. The memory component used in the design was the CMOS 6508 type of 1K X 1 static random access memory. A set of test equipment was surveyed comprising a Texas 990/4 computer, silent 700 terminal, interface unit, console and looms. Functional tests on the memory used specially developed test software, and included write-read checks on the memory in fault free conditions and under several conditions of simulated faults. Thermal testing was also performed. Author (ESA)

N80-31064# Computer Sciences Corp., Las Vegas, Nev.
COMMAND PROCEDURES FOR MANIPULATING TAPE DATA FILES: A SET OF PROCEDURES DEVELOPED FOR USE WITH THE COMNET ALPHA TIME SHARING SYSTEM Final Report, Jun. 1978 - Mar. 1979
R. A. McCrory and L. R. Williams Mar. 1980 32 p refs
Prepared in cooperation with EPA, Las Vegas, Nev.
(PB80-177546; EPA-600/8-80-013) Avail: NTIS HC A03/MF A01 CSCL 09B

The lack of simple terminal commands to manipulate tape data files is discussed. It enabled relatively inexperienced programmers or scientists to maintain large infrequently used data sets on magnetic tape. A set of terminal command language procedures which greatly simplify the maintenance of data files on magnetic tape is documented. The command procedures are invoked by entering a single work at the computer terminal. The computer queries the user for specific information and then submits a job to accomplish the actual data transfer. Ancillary procedures are included to facilitate the housekeeping requirements of tape management. The storage of large infrequently used data sets on magnetic tape saves ADP funds and frees system resources for other applications. Such savings lessen capital investment requirements as the agency's ADP needs expand. Disk storage charges are cut by 50 percent by the use of these procedures. GRA

N80-30330*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
AUTOMATED FREQUENCY STANDARD STABILITY DATA REDUCTION
L. J. Knapp *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 38-40 (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 09B

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N80-31065 Pennsylvania Univ., Philadelphia.
REVERSIBLE IMAGE COMPRESSION Ph.D. Thesis
Larry Bernard Grim 1980 180 p
Avail: Univ. Microfilms Order No. 8018551

Algorithms which are reversible and can be used to encode images for storage are examined. These algorithms make use of spatial redundancy found in the original in both the X and Y direction and also temporal redundancy between images in a sequence. It deviates from the standard approach to encoding in that it uses only computer length words and half words for the basic unit of storage and not the bit as was done by previous techniques. The images are first mapped into bit planes. The compression is then done on the individual bit planes. The use of bit planes provides significant advantage over compressing the original pixels. Dissert. Abstr.

N80-31066 Vanderbilt Univ., Nashville, Tenn.
AUGMENTED PREDICTIVE PARSING Ph.D. Thesis
Joseph Lovell Linn 1980 99 p
Avail: Univ. Microfilms Order No. 8018887

An Augmented Predictive parser which extends the Recursive Descent technique by making available more state information than is available in Recursive Descent parsers is described. The extra state information gives the Augmented Predictive parsers considerably more power. After providing a suitable formalism to describe the parsers it is shown that these Augmented Predictive parsers are just as powerful as the LR(k) parsers. A method by which an Augmented Predictive parser may be obtained from a deterministic context free grammar is given. Last, it is demonstrated that there are many cases where the parsers have considerable size advantages over parsers produced by other current techniques. Dissert. Abstr.

N80-31067 Idaho Univ., Moscow.
KL: A WELL-STRUCTURED BEGINNING COMPUTER LANGUAGE Ph.D. Thesis
Van Houten 1980 90 p
Avail: Univ. Microfilms Order No. 8019797

A programming language, KL, designed and developed specifically for use in introductory computer science courses is described. The structure of KL requires that each statement begin with a keyword and end with a semicolon. This decreases the implementation effort and adds to the simplicity of the language. This form also eliminates the necessity for reserved words which often cause difficulty for the user. The keywords have been chosen to be meaningful and, when possible, short. The tools needed for abstraction are included in KL. User defined data types are available in KL. Procedures and functions are also available for dividing a computer problem into subtasks. KL requires structured programming techniques because no other constructs are available. This should start good programming habits. The concepts of structured programming can be learned using KL and later applied to other less structured languages. Dissert. Abstr.

N80-31068 Massachusetts Univ., Amherst.
PATH SELECTION FOR SYMBOLIC EXECUTION SYSTEMS Ph.D. Thesis
John Lowe Woods 1980 192 p
Avail: Univ. Microfilms Order No. 8019505

A path generation method that may be used in conjunction with a symbolic execution system to analyze programs is described. This path generation method attempts to generate sets of paths that satisfy user selected program coverage goals. This method differs from previous attempts at path generation in that it uses a dynamic goal oriented approach in which paths are generated one statement at a time during the symbolic execution process. As each path is generated information is stored about the path and the area of the program it covers. Information from the current path and from previous paths is used at each step of the path generation process. Three different path situations are identified--branch selection, loop processing, and path generation in invoked procedure--and a different technique is developed to handle each of these situations. The method was implemented and tested. The test results indicate that the techniques developed are successful in producing paths that achieve a high degree of program coverage. Dissert. Abstr.

N80-31069 Rensselaer Polytechnic Inst., Troy, N. Y.
QUISP: A COMPUTER PROCESSOR FOR THE DESIGN AND DISPLAY OF QUADRIC-SURFACE BODIES Ph.D. Thesis
Joshua Zev Levin 1980 126 p
Avail: Univ. Microfilms Order No. 8020408

Quadric-surface bodies are useful for modelling manmade objects, and it is important that any computer aided design system be able to work with such bodies. The QUISP processor was designed to accept descriptions of quadric-surface bodies in either character string form (via the QUADRIL language), or through interactive input. The QUADRIL has a mixture of English-like and algebraic syntax. It may be used to specify quadric-surface bodies and then to display them on a variety of media. The interactive input allows commands to be entered by push buttons to accomplish anything that QUADRIL can do. The QUISP outputs line drawings of the quadric-surface bodies, with optional removal of hidden curves. All the lines in the drawings are projections of quadric-surface intersection curves, which are calculated using parametric methods. Dissert. Abstr.

N80-31070*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SCHEDULER SOFTWARE FOR TRACKING AND DATA RELAY SATELLITE SYSTEM LOADING ANALYSIS: USER MANUAL AND PROGRAMMER GUIDE
Ray Craft, Christel Dunn, Janet McCord, and Louis Simeone 13 Jun. 1980 101 p
(NASA-TM-78290) Avail: NTIS HC A06/MF A01 CSCL 09B

A user guide and programmer documentation is provided for a system of PRIME 400 minicomputer programs. The system was designed to support loading analyses on the Tracking Data Relay Satellite System (TDRSS). The system is a scheduler for various types of data relays (including tape recorder dumps and real time relays) from orbiting payloads to the TDRSS. Several model options are available to statistically generate data relay requirements. TDRSS time lines (representing resources available for scheduling) and payload/TDRSS acquisition and loss of sight time lines are input to the scheduler from disk. Tabulated output from the interactive system includes a summary of the scheduler activities over time intervals specified by the user and overall summary of scheduler input and output information. A history file, which records every event generated by the scheduler, is written to disk to allow further scheduling on remaining resources and to provide data for graphic displays or additional statistical analysis. Author

N80-31071*# Kentron International, Inc., Hampton, Va. Technical Center.
SEGMENTATION, DYNAMIC STORAGE, AND VARIABLE LOADING ON CDC EQUIPMENT
Sherwood H. Tiffany Sep. 1980 72 p refs
(Contract NAS1-16000)
(NASA-CR-3315) Avail: NTIS HC A04/MF A01 CSCL 09B

Techniques for varying the segmented load structure of a program and for varying the dynamic storage allocation, depending upon whether a batch type or interactive type run is desired, are explained and demonstrated. All changes are based on a single data input to the program. The techniques involve: code within the program to suppress scratch pad input/output (I/O) for a batch run or translate the in-core data storage area from blank common to the end-of-code+1 address of a particular segment for an interactive run; automatic editing of the segload directives prior to loading, based upon data input to the program, to vary the structure of the load for interactive and batch runs; and automatic editing of the load map to determine the initial addresses for in core data storage for an interactive run. Author

N80-31072*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A HILL-SLIDING STRATEGY FOR INITIALIZATION OF GAUSSIAN CLUSTERS IN THE MULTIDIMENSIONAL SPACE
John K. Park, Yung H. Chen, Daryl B. Simons, and Lee D. Miller Jul. 1980 29 p refs Presented at the Joint Soil and Machine Process. of Remotely Sensed Data Symp., West Lafayette, Ind., 3-6 Jun. 1980
(NASA-TM-80721; Rept-80F4508) Avail: NTIS HC A03/MF A01 CSCL 09B

A hill sliding technique was devised to extract Gaussian clusters from the multivariate probability density estimate of sample data for the first step of iterative unsupervised classification. Each cluster was assumed to posses a unimodal normal distribution. A clustering function proposed distinguished elements of a cluster under formation from the rest in the feature space. Initial clusters were extracted one by one according to the hill sliding tactics. A dimensionless cluster compactness parameter was proposed as a universal measure of cluster goodness and used satisfactorily in test runs with LANDSAT multispectral scanner data. The normalized divergence, defined by the cluster divergence divided by the entropy of the entire sample data, was utilized as a general separability measure between clusters. An overall clustering objective function was set forth in terms of cluster covariance matrices, from which the cluster compactness measure could be deduced. Minimal improvement of initial data partitioning was evaluated by this objective function in eliminating scattered sparse data points. The hill sliding clustering technique developed herein has the potential applicability to decomposition any multivariate mixture distribution into a number of unimodal distributions when an appropriate distribution function to the data set is employed. R.K.G.

N80-31073# Naval Surface Weapons Center, Dahlgren, Va.
COMPUTER PROGRAMMING AND CODING STANDARDS FOR THE FORTRAN AND SIMSCRIPT II.5 PROGRAMMING LANGUAGES Final Report
Robert T. Bevan and John H. Reynolds Apr. 1980 78 p refs
(AD-A086499; NSWC/TR-3878) Avail: NTIS HC A05/MF A01 CSCL 09/2

Contemporary studies of the software development process have shown definitively that an 'ad-hoc' attempt at developing large and complex programming systems yields software that is too expensive, too difficult to maintain, inefficient, and, often, incorrect. Worse, it is very difficult to assure oneself that it is correct. This report deals with standards that make the

development of programs a more precise process. This does not mean to imply that use of a rigorous set of programming standards is a panacea for computer programming. On the contrary, use of standards merely reduces the number of errors introduced. Using standards such as those documented in this report will be seen to require more effort on the part of the programming staff than heretofore. This effort is not in vain, however, since the additional effort consists of tasks that were simply not done in the approaches of the past. Additionally, standards greatly improve the reliability, maintainability, and transportability of the resultant programs. GRA

N80-31074# Weapons Systems Research Lab., Adelaide (Australia).
DISCRETE/CONTINUOUS SIMULATION LANGUAGE
T. J. Packer, J. R. Coleby, and T. J. Galvin Jun. 1979 92 p
(AD-A086487; WSRL-0104-TR) Avail: NTIS
HC A05/MF A01 CSCL 09/2

This report takes the form of a user guide for the Discrete/Continuous Simulation Language (DCSL). This language has been developed to allow the convenient setting-up of simulations based directly upon models formulated in a graphical modelling language referred to here as GML. The DCSL System Program is written in FORTRAN and hence DCSL is easily implemented on most modern machines. GRA

N80-31075# Wisconsin Univ. - Madison. Mathematics Research Center.
GENERALIZED EQUATIONS AND THEIR SOLUTIONS. PART 2: APPLICATIONS TO NONLINEAR PROGRAMMING Summary Report
Stephen M. Robinson Mar. 1980 31 p refs
(Contract DAAG29-75-C-0024; Grant NSF MCS-79-01066)
(AD-A086365; MRC-TSR-2048) Avail: NTIS
HC A03/MF A01 CSCL 12/1

We prove that if the second-order sufficient condition and constraint regularity hold at a local minimizer of a nonlinear programming problem, then for sufficiently smooth perturbations of the constraints and objective function the set of local stationary points is nonempty and continuous; further, if certain polyhedrality assumptions hold (as is usually the case in applications) then the local minimizers, the stationary points and the multipliers all obey a type of Lipschitz condition. Through the use of generalized equations, these results are obtained with a minimum of notational complexity. GRA

N80-31076# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
GRAPH: AN INTERACTIVE COMPUTER PROGRAM USED FOR TECHNICAL PLOTTING Final Report, 1 Jul. 1977 - 1 Aug. 1978
Sandra K. Drake Apr. 1980 100 p Revised
(AF Proj. 3066)
(AD-A086354; AFAPL-TR-78-90) Avail: NTIS
HC A05/MF A01 CSCL 09/2

This technical report describes a computer program 'graph' which supplies a capability to do efficient plotting of all types of analytical data in a manner suitable for direct substitution into technical papers and articles. DISPLA, a prepackaged set of subroutines from Integrated Software Systems Corporation was used in creation of 'graph'. Input is designed for the TEK4010 on-line computer terminal. Style and format of the created plot is specified by the user through interactive questions and answers. Options include special alphabets, curve fitting procedures, axis labeling and scaling, and the use of multi-curves. GRA

N80-31077# Northwestern Univ., Evanston, Ill. Dept. of Electrical Engineering and Computer Science.
SELF-METRIC SOFTWARE. VOLUME 1: SUMMARY OF TECHNICAL PROGRESS Final Technical Report, 1 Aug. 1976 - 15 Jan. 1980
Stephen S. Yau Griffiss AFB, N.Y. RADC Apr. 1980 110 p refs
(Contract F30602-76-C-0397; AF Proj. 5581)
(AD-A086290; RADC-TR-80-138-Vol-1) Avail: NTIS
HC A06/MF A01 CSCL 09/2

This report documents the research performed under RADC Contract by Northwestern University in the area of developing effective techniques for large scale software maintenance, including those for the design, implementation, validation, and evaluation of reliable and maintainable software systems with a high degree of automation. During this contract period, research in the areas of ripple effect analysis, testing during software maintenance, specification for program modifications, quality factors for software maintainability, and dynamic monitoring of program behavior was conducted. In this report, the software maintenance process is first described. The research results which have been presented in previous papers and interim technical reports are summarized, and unfinished work is presented. GRA

N80-31078# Northwestern Univ., Evanston, Ill. Dept. of Electrical Engineering and Computer Science.
SELF-METRIC SOFTWARE. VOLUME 2: A HANDBOOK. PART 1: LOGICAL RIPPLE EFFECT ANALYSIS Final Technical Report, Aug. 1976 - Jan. 1980
Steven S. Yau, James S. Collofello, and Chung-Chu Hsieh Griffiss AFB, N.Y. RADC Apr. 1980 41 p refs 3 Vol.
(Contract F30602-76-C-0397; AF Proj. 5581)
(AD-A086291; RADC-TR-80-138-Vol-2-Pt-1) Avail: NTIS
HC A03/MF A01 CSCL 09/2

This handbook concists of two parts on ripple effect analysis for large-scale software maintenance. In part 1, a ripple effect analysis technique for software maintenance from the logical or functional perspective is presented. In a separate volume, part 2 of the handbook, a ripple effect analysis technique for software maintenance from the performance perspective is presented. The purpose of this handbook is to present ripple effect analysis techniques to assist software maintenance personnel to do a better job in large-scale software maintenance. The material presented in this handbook is organized in three levels. At the first level, the software maintenance process is described and the need for effective ripple effect and techniques for large-scale software maintenance is given. The capabilities and restrictions of the logical ripple effect analysis technique, as well as how this technique is interfaced with the user, are presented. At the second level, the logical ripple effect analysis technique is outlined in two phases: the lexical analysis phase and the tracing phase. At the third level, the steps of the logical ripple effect analysis technique are given in detail. However, the detailed theory behind this technique is not presented in ths handbook, but contained in other reports. GRA

N80-31079# Northwestern Univ., Evanston, Ill. Dept. of Electrical Engineering and Computer Science.
SELF-METRIC SOFTWARE. VOLUME 3: A HANDBOOK. PART 2: PERFORMANCE RIPPLE EFFECT ANALYSIS Final Technical Report, Aug. 1976 - Jan. 1980
Steven S. Yau and James S. Collofello Griffiss AFB, N.Y. RADC Apr. 1980 46 p refs 3 Vol.
(Contract F30602-76-C-0397; AF Proj. 5581)
(AD-A086292; RADC-TR-80-138-Vol-3-Pt-2) Avail: NTIS
HC A03/MF A01 CSCL 09/2

In this volume part 2 of the handbook, a ripple effect analysis technique for software maintenance from the performance perspective is presented. The purpose of this handbook is to present ripple effect analysis techniques to assist software maintenance personnel to do a better job in large-scale software maintenance. The material presented in this handbook is organized in three levels. At the first level, the software maintenance process is described and the need for effective ripple effect analysis techniques for large-scale software maintenance is given. The capabilities and restrictions of the performance ripple effect analysis technique, as well as how this technique is interfaced with the user, are presented. At the second level, the performance ripple effect analysis technique is outlined in two phases: the lexical analysis phase and the tracing phase. At the third level, the steps of the performance ripple effect analysis technique is not presented in this handbook, but contained in other reports. Finally, the integration of the processing steps of the performance ripple effect analysis and the logical ripple effect analysis is discussed. GRA

N80-31080# Texas Univ., Austin. Center for Cybernetics Studies.
A DUAL ALGORITHM TO SOLVE LINEAR LEAST ABSOLUTE

VALUE APPROXIMATIONS
Ronald Armstrong and Mabel Kung (McMaster Univ.) Jun. 1980 19 p refs
(Contracts N00014-75-C-0569; N00014-80-C-0242)
(AD-A087078; CCS-RR-370) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper presents a special purpose dual linear programming algorithm to solve linear least absolute value problems. In addition, strategies involving start procedures are examined. Implementations of computer based techniques are discussed. Computational results with three computer code versions of the algorithm are given. GRA

N80-31081# Texas Univ. at Austin. Applied Research Labs.
USER'S MANUAL FOR NEMESIS AND PLMODE
Ruth Gonzalez and Susan G. Payne 1 May 1980 132 p
(Contract N00014-79-C-0263)
(AD-A087254; ARL-TM-80-6) Avail: NTIS HC A07/MF A01 CSCL 09/2

The normal mode model, NEMESIS, was designed and implemented at the Applied Research Laboratories, The University of Texas at Austin ARL'S (UT), to aid in the investigation of low frequency, range invariant, acoustic propagation effects. The mathematical basis and numerical scheme of this model are described by Gonzalez and Hawker (1980). NEMESIS computes the eigenvalues and normal modes of the depth separated acoustic wave equation. Group velocities and modal attenuation terms are also computed. Propagation loss and velocity potential for a source and receiver at a given range can be calculated from these quantities (Gonzalez and Hawker, 1980). A computer model, PLMODE, was designed to perform these computations, and the computer code for both NEMESIS and PLMODE was prepared for export to other research laboratories. This report is designed to accompany this software and to assist persons who wish to use it. The contents include descriptions of the modeled environment, the input data and their format, and the output produced by the models. An explanation of the diagnostic messages that may arise during execution of the models is also included. Estimates of memory requirements and execution times are given along with sample data sets and their resulting output. GRA

N80-31082# Illinois Univ. at Chicago Circle, Chicago. Dept. of Mathematics.
A COMPUTER ALGORITHM FOR GENERATING A BASIS OF THE TRADES ON T-DESIGNS Interim Report
A. Hedayat and Huey-Luen Hwang Jun. 1980 22 p refs
(Grant AF-AFOSR-3050-76; AF Proj. 2304)
(AD-A087251; AFOSR-80-0561TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

To study the existence and nonexistence of t-designs it is enough to investigate a combinatorial structure called trades on t-designs. This report presents a computer algorithm for generating the basis of trade on t-designs. The technique is elucidated via several examples. GRA

N80-31083# Oak Ridge National Lab., Tenn. Fusion Energy Div.
HLYWD: A PROGRAM FOR POST-PROCESSING DATA FILES TO GENERATE SELECTED PLOTS OR TIME LAPSE GRAPHICS
J. K. Munro, Jr. May 1980 65 p refs
(Contract W-7405-eng-26)
(ORNL/CSD/TM-109) Avail: NTIS HC A04/MF A01

The program HLYWD is a post processor of output files generated by large plasma simulation computations or of data files containing a time sequence of plasma diagnostics. It is intended to be used in a production mode for either type of application; i.e., it allows one to generate along with the graphics sequence, segments containing title, credits to those who performed the work, test to describe the graphics, and acknowledgement of funding agency. The current version is designed to generate 3D plots and allows one to select type of display (linear or semilog scales), choice of normalization of function values for display purposes, viewing perspective, and an option to allow continuous rotations of surfaces. This program was developed with the intention of being relatively easy to use, reasonably flexible, and requiring a minimum investment of the user's time. DOE

N80-31084# Software und Engineering fuer Daten- verarbeitungs- und Automationssysteme, Frankfurt am Main (West Germany).
RELIABILITY OF SOFTWARE GENERATED BY LANGUAGE PROCESSORS
Konrad F. Kreuter Jul. 1979 192 p refs
(Contract ESA-3490/78-D-JS(SC))
(SESA-P35532; ESA-CR(P)-1333) Avail: NTIS HC A09/MF A01

The elements which a programming language must provide to allow a homologous mapping of different levels of problem formulation are identified. An example problem is formulated at six different levels of refinement to demonstrate aspects to be considered between the first draft of an algorithm down to a complete machine dependent implementation with minimum storage requirements for data. For all these levels, ALGOL 68 is used as a notational tool. This was done to show that it is not necessary to use different languages when describing a problem and its solution on different levels of abstraction, provided the language has enough expressive power. There are other programming languages with equal behavior. A comparison of the languages ALGOL 68, PL/1, CPL1, HAL/S, PEARL, and the requirements for the language ADA are given. Author (ESA)

N80-31085# European Space Agency, Paris (France).
USER'S GUIDE FOR A COMPUTER SIMULATION PROGRAM FOR MULTI-RIGID-BODY SYSTEMS
P. Boland (ESTEC, Noordwijk, Netherlands) Feb. 1980 74 p refs
(ESA-STM-216) Avail: NTIS HC A04/MF A01

The FORTRAN 4 program provides the solution to large rotations of arbitrary, joint connected, rigid body systems. Relative rotations are described by Tait-Bryan angles in a 1-2-3 sequence. The interface between the main core of the program and the user consists of subroutines that make it possible to accommodate external perturbations, connection torques or prescribed motions. System modelling and input and output procedures are explained in detail. Several explicit examples are given, to illustrate the versatility of the program. The complete list of instructions is provided. Author (ESA)

62 COMPUTER SYSTEMS

Includes computer networks.

N80-31086 Polytechnic Inst. of New York.
THROUGHPUT CALCULATIONS FOR MULTIPROCESSOR COMPUTER SYSTEMS Ph.D. Thesis
Mehmet Ulema 1980 225 p
Avail: Univ. Microfilms Order No. 8019418

Approximate analytic methods for evaluating the performance of multiprocessor systems are described. A processor oriented approach is developed to calculate the throughput of a multiprocessor system by building a Markov chain model taking the state as the number of processors working (active) at a unit time interval. The assumption is made that a processor may be active using a memory module or active without using a memory module, or may not be active waiting for a memory module to become free. To simplify the computations for systems with large numbers of processors, queued processors will be permitted to make (possibly) new requests at the end of a cycle. Asymptotic expressions are also derived for the systems with large numbers of processors. In describing the importance of bus communication techniques, it is demonstrated how the analysis can be used for the synchronous and asynchronous type bus communication techniques in a time shared/common bus interconnection structure which is an example of the partially connected topology. Dissert. Abstr.

N80-31087# California Univ., Berkeley. Electronics Reserach Lab.
THE DESIGN METHODOLOGY OF DISTRIBUTED COMPUTER SYSTEMS Final Technical Report, 1 Jul. 1978 - 30 Jun. 1979

C. V. Ramamoorthy May 1980 201 p refs
(Grant AF-AFOSR-3630-78; AF Proj. 2304)
(AD-A086690; AFOSR-80-0542TR) Avail: NTIS HC A10/MF A01 CSCL 09/2

Performance evaluation techniques for asynchronous concurrent systems is developed using the Petri net approach. Analysis techniques for deadlocks in asynchronous concurrent systems is also explored. Moreover, a need for adaptive reconfiguration techniques is established along with necessary and sufficient conditions for reconfigurability. Then a method is described for evaluating the available reconfiguration strategies based on a figure of merit. GRA

N80-31087# National Bureau of Standards, Washington, D.C. Inst. for Computer Sciences and Technology.
SIZING DISTRIBUTED SYSTEMS: OVERVIEW AND RECOMMENDATIONS Final Report
Sandra A. Mamrak May 1980 25 p refs
(PB80-184377; NBS-SP-500-60; LC-80-600061) Avail: NTIS HC A02/MF A01 CSCL 09B

An overview of sizing techniques, a brief discussion of the factors that affect choosing one or a combination of techniques, and a set of recommendations for choosing tools for sizing distributed systems is given. GRA

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

N80-31088# Yale Univ., New Haven, Conn. Dept. of Computer Science.
AFFECT UNITS AND NARRATIVE SUMMARIZATION Research Report
Wendy S. Lehnert May 1980 58 p refs
(Contract N00014-75-C-1111; Grant NSF IST-79-18463)
(AD-A086735; RR-179) Avail: NTIS HC A04/MF A01 CSCL 05/7

The analysis of narrative text involves various levels of description. On the lowest level are word meanings and syntactic structure within single sentences. On a higher level there are problems of generating inferences and integrating information into memory. At the highest level is the notion of a macro-structure or narrative plot. The identification of high-level narrative structures is central to the problem of narrative summarization. But the intuitive notion of a plot is useless for a process model of summarization unless we can specify the hierarchical representations that allow us to analyze input and produce plots as output. A representational strategy has been developed for high-level structural analysis in conjunction with the BORIS system (a narrative text understanding system). The structures produced effectively encode plot lines in terms of connected graph structures where graph nodes correspond to specific affect units. An affect unit is an abstraction of affective causality which is recognized in a bottom-up manner at the time of understanding. Simple manipulations of these graph structures yield the conceptual basis for narrative summaries, but the actual process of summarization depends on certain connectivity properties in the graph structure. GRA

N80-31090# University of Southern California, Los Angeles. Dept. of Electrical Engineering.
TIGHT ROUNDS ON THE RESPONSE OF MULTIVARIABLE SYSTEMS WITH COMPONENT UNCERTAINTY
Michael G. Safonov 31 Aug. 1979 10 p refs
(Contract F44620-76-C-0061; Grant NSF ENG-78-05628)
(AD-A086580) Avail: NTIS HC A02/MF A01 CSCL 12/2

For Multi-Input-Multi-Output (MIMO) feedback systems having internal components that are subject to parameter variations, nonlinearity, or unmodeled dynamics within given 'conic sector' bounds, tight bounds (which also turn out to take the form of 'conic sector' bounds) are derived for the input-output relation of the closed-loop system. In the case of linear-time invariant systems, the 'conic sector' bounds are interpretable in terms of the maximal singular values of certain frequency-response matrices. GRA

N80-31091# California Univ., Berkeley. Electronics Research Lab.
FOUNDATIONS OF FEEDBACK THEORY FOR NONLINEAR DYNAMICAL SYSTEMS
C. A. Desoer and Y. T. Wang 31 Aug. 1979 83 p refs Submitted for publication
(Contract F44620-76-C-0100; Grant NSF ENG-76-84522)
(AD-A086578) Avail: NTIS HC A05/MF A01 CSCL 09/3

We study the fundamental properties of feedback for nonlinear, time-varying, multi-input, multi-output, distributed systems. The classical Black formula is generalized to the nonlinear case. Achievable advantages and limitations of feedback in nonlinear dynamical systems are classified and studied in five categories: desensitization, disturbance attenuation, linearizing effect, asymptotic tracking and disturbance attenuation, linearizing effect, asymptotic tracking and disturbance rejection, stabilization. Conditions under which feedback is beneficial for nonlinear dynamical systems are derived. Our results show that if the appropriate linearized inverse return difference operator is small, then the nonlinear feedback system has advantages over the open-loop system. Several examples are provided to illustrate the results. GRA

N80-31092# Massachusetts Inst. of Tech., Cambridge. Dept. of Electrical Engineering and Computer Science.
ROBUSTNESS WITH OBSERVERS
J. C. Doyle (Honeywell Systems and Research Center) and G. Stein 31 Aug. 1979 20 p refs
(AD-A086610) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper describes an adjustment procedure for observer-based linear control systems which asymptotically achieve the same loop transfer functions (and hence the same relative stability, robustness, and disturbance rejection properties) as full state feedback control implementations. GRA

N80-31093# Honeywell Systems and Research Center, Minneapolis, Minn.
ON FEEDBACK SYSTEMS POSSESSING INTEGRITY WITH RESPECT TO ACTUATOR OUTAGES
C. A. Harvey 31 Aug. 1979 11 p refs
(Contract ET-78-C-01-3391)
(AD-A086609) Avail: NTIS HC A02/MF A01 CSCL 12/1

For systems that are open-loop stable, there is a class of feedback controllers that have the property that the closed loop system is stable and remains stable in case actuator outages occur. Properties of a special subclass of these controllers are discussed. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N80-31094 Iowa State Univ. of Science and Technology, Ames.
STABILITY OF POWER SYSTEMS AND OTHER SYSTEMS OF SECOND ORDER DIFFERENTIAL EQUATIONS Ph.D. Thesis
Sherwin James Skar 1980 147 p
Avail: Univ. Microfilms Order No. 8019664

Analytic criteria are developed to predict the stability or instability of equilibrium points of systems of second order differential equations. The results are applied to the swing equations for electric power systems. It is shown that the trivial solution is exponentially stable if and only if the linearization matrix is stable. This rapid rate of convergence ensures that the asymptotic stability of a certain subsystem will imply the stability of the whole system. In the case of uniform damping, stability results proved by linearization allow one to classify equilibrium points as either stable or unstable, except for a certain critical case. To help implement these and related results, an algorithm is developed to determine whether all eigenvalues of a matrix are real and nonpositive. Other stability criteria are proved using invariance theory and an extension of the concept of Hamilton-

ian systems. A sufficient condition for a nonlinear map being one to one in a convex region is proved. A simple analytic criterion for the existence of stable equilibrium states is proved for the swing equations with negligible transfer conductances. Dissert. Abstr.

N80-31095 Rensselaer Polytechnic Inst., Troy, N. Y.
AN ADAPTIVE GRID FINITE ELEMENT METHOD FOR INITIAL-BOUNDARY VALUE PROBLEMS Ph.D. Thesis
Stephen Francis Davis 1980 225 p
Avail: Univ. Microfilms Order No. 8020401

A finite element method is developed to solve initial boundary value problems for vector systems of parabolic partial differential equations in one space dimension and time. The methods adapt the computational mesh as the solution progresses in time and are thus able to follow and resolve such sharp transitions as boundary layers, shock layers, or wave fronts. This permits an accurate solution to be calculated with fewer mesh points than would be necessary with a uniform mesh. The overall method contains two parts, a solution algorithm and a mesh selection algorithm. The solution algorithm is a finite element-Galerkin method on trapezoidal space time elements, using either piecewise linear or cubic polynomial approximations. The mesh selection algorithm builds upon variable knot spline interpolation. Error estimates are obtained for the solution algorithm. The mesh selection algorithm is shown to produce a mesh which minimizes the L sq error of the solution for a given number of mesh points. A computer code implementing these algorithms has been written and applied to a number of problems. Dissert. Abstr.

N80-31096 California Inst. of Tech., Pasadena.
ALGEBRAIC CODING THEORY Ph.D. Thesis
Robert Calderbank 1980 75 p
Avail: Univ. Microfilms Order No. 8019886

Quadratic residue codes, quasicyclic binary codes, and symmetry codes are investigated. It is shown how to regard such a code as an ideal in an algebra generated by a group of automorphisms of the code. The algebra is then used to establish a square root bound on the minimum weight of the code. The extended quadratic residue codes of length (q + 1), where q is an odd prime power, are constructed from representations of the special linear group, SL sub 2 (q). A square root bound is established on the minimum weight in quasi-cyclic binary codes. The construction of symmetry codes is extended to fields other than GF(3). Given an odd prime power q, and a finite field F of odd characteristic containing the square root of -q, a (2q + 2, q + 1) symmetry code over F is constructed. A square root bound is established on the minimum weight in this enlarged family of symmetry codes. When q is identical to -1 (mod 4) this bound is tight and is achieved by an (8,4,4) code over GF(7). Additional results are presented. Dissert. Abstr.

N80-31097*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RELATIONSHIPS AMONG THE SLOPES OF LINES DERIVED FROM VARIOUS DATA ANALYSIS TECHNIQUES AND THE ASSOCIATED CORRELATION COEFFICIENT
Steven C. Cohen Jul. 1980 7 p ref Submitted for publication
(NASA-TM-80733) Avail: NTIS HC A02/MF A01 CSCL 12A

A technique for fitting a straight line to a collection of data points is given. The relationships between the slopes and correlation coefficients, and between the corresponding standard deviations and correlation coefficient are given. T.M.

N80-31098# Stanford Univ., Calif. Div. of Applied Mechanics.
ON MATCHED ASYMPTOTIC EXPANSIONS AND THE CALCULUS OF VARIATIONS Interim Report
H. Pasic and G. Herrmann Jun. 1980 19 p refs
(Contract N00014-76-C-0054)
(AD-A086807; SUDAM-80-3) Avail: NTIS HC A02/MF A01 CSCL 12/1

It is shown, with the aid of two examples, that the calculus of variations may be used to an advantage over the method of matched asymptotic expansions in solving singular boundary layer problems of applied mechanics. It is shown, with the aid of two examples, that the calculus of variations may be used to an advantage over the method of matched asymptotic expansions in solving singular boundary-layer problems of applied mechanics. GRA

N80-31099# Wisconsin Univ. - Madison. Mathematics Research Center.
CONVERGENCE ESTIMATES FOR SEMIDISCRETE PARABOLIC EQUATION APPROXIMATIONS Technical Summary Report
Peter H. Sammon Mar. 1980 49 p refs
(Contract DAAG29-75-C-0024; Grant NSF MCS-78-09525)
(AD-A086369; MRC-TSR-2053) Avail: NTIS HC A03/MF A01 CSCL 12/1

In this paper, we study certain semidiscrete methods for approximating the solutions of initial boundary value problems, with homogeneous boundary conditions, for certain kinds of parabolic equations. These semidiscrete methods are based upon the availability of several different Galerkin-type approximation methods for the associated elliptic steady-state problem. The properties required of the spacial discretization methods are listed and estimates of the error made by the resulting semidiscrete approximations and of its time derivatives are given. In particular, estimates are given that require only weak smoothness assumptions on the initial data. Verifications of the required properties for various Galerkin-type methods are also given. GRA

N80-31100# Wisconsin Univ. - Madison. Mathematics Research Center.
ON THE MAXIMUM PRINCIPLE FOR PSEUDOPARABOLIC EQUATIONS Technical Summary Report
Emmanuele DiBenedetto and Michel Pierre Apr. 1980 56 p refs
(Contracts DAAG29-80-C-0041; DAAG29-75-C-0024; Grant NSF MCS-78-09525)
(AD-A086380; MRC-TSR-2063) Avail: NTIS HC A04/MF A01 CSCL 12/1

This report considers the equation d/dt (mu lambda delta mu)-delta mu=0 in a cylindrical domain. Unlike the heat equation, the positivity of the boundary data is not sufficient to insure that the solution is nonnegative. It is desirable to identify those boundary data for which the above property is true. One reason is that, since the above equation is a model for heat conduction and for fluid flow in fractured porous media, it is of interest to locate those boundary data that make the correspondent physical process meaningful. In this paper several boundary value problems associated with the above equation are studied and necessary and sufficient conditions on the data are given to insure the nonnegativity of the solution. GRA

N80-31101# Wisconsin Univ. - Madison. Mathematics Research Center.
CONVERGENT APPROXIMATIONS IN PARABOLIC VARIATIONAL INEQUALITIES. 2: HAMILTON-JACOBI INEQUALITIES Summary Report
Joseph W. Jerome Mar. 1980 18 p refs
(AD-A086364; MRC-TSR-2047) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper studies the two-sided differential inequality which characterizes the optimal payoff in a two person differential game, when the strategies available to the players are stopping times. By converting the inequality to an equation via a so-called penalization method, we are able to apply a standard numerical method for approximating solutions of nonlinear equations. We obtain new rates of convergence for the procedure. GRA

N80-31102# Wisconsin Univ. - Madison. Mathematics Research Center.
ON THE NUMBER OF PERIODIC TRAJECTORIES FOR A HAMILTONIAN FLOW AND A CONVEX ENERGY SURFACE
Ivar Ekeland and Jean-Michel Lasry Mar. 1980 49 p refs
(Contract DAAG29-75-C-0024)
(AD-A086367; MRC-TSR-2050) Avail: NTIS HC A03/MF A01 CSCL 12/1

In this paper, it is assumed that the Hamiltonian H is convex of IR(n) x IR(n), and that the origin (0,0) is an isolated equilibrium.

It is also assumed that some ball B around the origin can be found such that the energy surface H to the minus 1(h) lies outside B but inside square root of 2 B. Under these assumptions, we prove that there are at least n distinct periodic orbits of the Hamiltonian flow (H) with energy level h. GRA

N80-31103# Wisconsin Univ. - Madison. Mathematics Research Center.

STATIONARY POINTS AND FINITE-DIFFERENCE SCHEMES FOR DIFFERENTIAL INCLUSIONS Summary Report

Jean-Pierre Aubin Apr. 1980 29 p refs

(Contracts DAAG29-75-C-0024; DAAG29-80-C-0041)

(AD-A086381; MRC-TSR-2063) Avail: NTIS HC A03/MF A01 CSCL 12/1

So called 'differential inclusions', in which the rate of change x(dot) of the state variable x is restricted to lie in a specified set F(x) (and not given exactly) arise naturally in economics, control theory and other fields. As with differential equations, one is interested in the existence of stationary points. Here it is shown that if F is tangent to a compact convex set (in a sense made precise), then the differential inclusion has a stationary point within this set. Moreover, a discrete implicit difference scheme which approximates the inclusion will also be solvable when the tangency condition holds and the initial data is chosen from the set. GRA

N80-31104# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.

STABILITY OF DICED SYSTEMS Interim Report

T. L. Johnson Mar. 1980 21 p refs

(Contracts F49620-80-C-0002; ET-76-C-01-2295; AF Proj. 2304)

(AD-A086685; LIDS-P-980; AFOSR-80-0547TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Diced systems are defined as autonomous systems governed by ordinary differential equations having discontinuities (in R to the nth power) on submanifolds where one or more of the state variables takes an integer value. Such systems may be regarded as approximations of continuous systems or as representative models of a class of discontinuous systems. Trajectories of such systems (for a given initial state) are readily calculated and may exhibit complex sliding-mode segments. Asymptotic properties of such trajectories are discussed and classified. Motivation is given in terms of observed properties of interconnected power systems. GRA

N80-31105# Delaware Univ., Newark. Applied Mathematics Inst.

ANALYTIC CONTINUATION OF SOLUTIONS TO LINEAR PARTIAL DIFFERENTIAL EQUATIONS Interim Report

David Colton 1980 20 p refs

(Grants AF-AFOSR-2879-76; NSF MCS-78-02542)

(AD-A086712; TR-76A; AFOSR-80-0498TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

In this paper we shall indicate some of the current directions in the study of the analytic continuation of solutions to partial differential equations. Our intended audience is not only those mathematicians working in the area of partial differential equations, but also complex analysts interested in seeing how a major topic in the theory of analytic functions can be extended to include certain classes of linear partial differential equations. Our specific aim is to provide a survey of the general area of the analytic continuation of solutions to partial differential equations and their application. GRA

N80-31106# Delaware Univ., Newark. Applied Mathematics Inst.

ALGORITHMS ANALYSIS OF A MARKOVIAN MODEL FOR A SYSTEM WITH BATCH AND INTERACTIVE JOBS Interim Report

Jean Paul Colard and Guy Latouche Mar. 1980 35 p refs

(Grants AF-AFOSR-3236-77; NSF ENG-79-08351; AF Proj. 2304)

(AD-A086711; TR-52B; AFOSR-80-0500TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

A computer system serving both batch and interactive jobs is modeled as a single server queue, with an infinite source of ordinary customers and a finite source of priority customers. The stability condition and the stationary probability distribution are determined. For a stable system, it is shown how the distribution and moments, of the waiting time, the sojourn time, the completion time, and the busy period, may be efficiently computed. GRA

N80-31107# Clarkson Coll. of Technology, Potsdam, N.Y.

LUMPED NONLINEAR SYSTEM ANALYSIS WITH VOLTERRA SERIES Final Phase Report, Nov. 1978 - Nov. 1979

H. K. Thapar and B. J. Leon Apr. 1980 175 p refs

(Contract F30602-78-C-0102; AF Proj. 2338)

(AD-A086428; RADC-TR-80-140) Avail: NTIS HC A08/MF A01 CSCL 09/3

This study investigates the application aspect of the Volterra series method to nonlinear system analysis, with special emphasis on nonlinear circuits. The contents are organized into five parts: (1) important aspects of Volterra series method; (2) characterization of multiple nonlinearity circuits (systems) using Volterra series; (3) response on nonlinear systems from Volterra series system characterization; (4) Computer-aided analysis of mildly nonlinear circuits using Volterra series; and (5) concrete examples from the application of Volterra series method to nonlinear circuit problems. Algorithms for adapting the Volterra series method for the computer-aided distortion and zero-state transient analysis of mildly nonlinear circuits are developed next. A symbolic approach is used which not only improves the computational efficiency but also provides a link to the earlier ideas on convergence, etc. An overview of the digital computer program PRANC, which uses the Volterra series method, is also given. GRA

N80-31108# Wisconsin Univ. - Madison. Mathematics Research Center.

REGULARIZING EFFECTS OF HOMOGENEOUS EVOLUTION EQUATIONS

Michael G. Crandall and Philippe Benilan May 1980 23 p refs

(Contracts DAAG29-75-C-0024; DAAG29-80-C-0041)

(AD-A086561; MRC-TSR-2076) Avail: NTIS HC A02/MF A01 CSCL 12/1

It is well known that solving the initial-value problem for the heat equation forward in time takes a 'rough' initial temperature into a temperature which is smooth at later times t = greater than 0. One aspect of this is the validity of certain estimates on tut when u is a solution of the heat equation. In this paper we prove related estimates on nonlinear evolution equations which are governed by homogeneous nonlinearities. The results apply to classes of nonlinear diffusion equations and to conservation laws. The results are interesting from the point of view of identifying a new 'regularization' mechanism and the estimates themselves cast new light on the nature of the solutions of some initial-value problems with rough initial data. GRA

N80-31109# Wisconsin Univ. - Madison. Mathematics Research Center.

VIABLE AND MONOTONE TRAJECTORIES OF DIFFERENTIAL INCLUSIONS

Jean-Pierre Aubin Apr. 1980 32 p refs

(Contracts DAAG29-75-C-0024; DAAG29-80-C-0041)

(AD-A086382; MRC-TSR-2064) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper begins with an exposition of results of Haddad on the solvability of differential inclusion (in which the rate of change x(dot) of the state variable x is restricted to lie in a specified at F(x) and is not given exactly) for a solution x with x(t) epsilon K for t greater than or = 0 and K a specified set of 'viable states'. Problems of this sort arise naturally in control theory and economics. A main point is the generality of the assumptions under which the theory is successful. Results on monotone trajectories and the convergence of a generalized Newton method to a rest state are also presented. GRA

N80-31110# Wisconsin Univ. - Madison. Mathematics Research Center.

HOW TO HOMOGENIZE A NONLINEAR DIFFUSION EQUATION E.G. STEFANS PROBLEM

Alain Damlamian (Paris-Sud Univ.) Apr. 1980 17 p refs
(Contracts DAAG29-75-C-0024; DAAG29-80-C-0041)
(AD-A086379; MRC-TSR-2061) Avail: NTIS
HC A02/MF A01 CSCL 20/13

This report discusses the homogenization of a Stefan problem (i.e., heat conduction with change of phase) when the structure is epsilon-periodic and proves that the constitutive laws of the limit medium do not depend upon the boundary conditions and are those of an anisotropically heat conducting medium which undergoes a change of phase at each temperature of change of phase of the original substance. GRA

N80-31111# Wisconsin Univ. - Madison. Mathematics Research Center.

FULLY NONLINEAR SECOND ORDER ELLIPTIC EQUATIONS WITH LARGE ZEROTH ORDER COEFFICIENT

Lawrence C. Evans (Kentucky Univ.) and Pierre-Louis Lions (Paris Univ.) Apr. 1980 22 p refs
(Contracts DAAG29-80-C-0041; DAAG29-75-C-0024; Grant NSF MCS-77-01952)
(AD-A086383; MRC-TSR-2065) Avail: NTIS
HC A02/MF A01 CSCL 12/1

This report proves the existence of classical solutions to certain fully non-linear second order elliptic equations with large zeroth order coefficient. The principal tool is an a priori estimate asserting that the C superscript 2, alpha-norm of the solution cannot lie in a certain interval of the positive real axis. GRA

N80-31112# Wisconsin Univ. - Madison. Mathematics Research Center.

ASYMPTOTIC BEHAVIOR OF POSITIVE SOLUTIONS OF NONLINEAR VOLTERRA EQUATIONS FOR HEAT FLOW

Ph. Clement (Technische Hogeschool, Delft, Netherlands) and J. A. Nohel May 1980 37 p refs
(Contracts DAAG29-75-C-0024; DAAG29-80-C-0041; Grant DAAG29-77-G-0004)
(AD-A086385; MRC-TSR-2069) Avail: NTIS
HC A03/MF A01 CSCL 20/11

This report considers nonlinear heat flow in a homogeneous bar of unit length of a material with memory with the ends of the rod maintained at zero temperature and with the history of temperature prescribed for time t less than or be known for the physical problem. The operator (A) in (V) is a nonlinear differential operator together with boundary conditions, and the forcing term f in (V) depends on the given initial temperature distribution, the given external heat supply, and the given history of temperature. GRA

N80-31113# Wisconsin Univ. - Madison. Mathematics Research Center.

ASYMPTOTIC PROPERTIES OF SOLUTIONS OF NONLINEAR ABSTRACT VOLTERRA EQUATIONS

Ph. Clement (Technische Hogeschool, Delft, Netherlands), R. C. MacCamy (Carnegie-Mellon Univ.), and J. A. Nohel May 1980 44 p refs
(Contracts DAAG29-80-C-0041; DAAG29-75-C-0024; Grants DAAG29-77-G-0004; NSF MCS-77-01149)
(AD-A086387; MRC-TSR-2070) Avail: NTIS
HC A03/MF A01 CSCL 20/11

A general theory is developed which gives sufficient conditions in terms of the kernel b, the operator A, and the forcing term f for the solution u of (V) to be bounded on o < t < infinity and which further assures that the solution u tends to a limit u sub infinity as t approaches infinity under certain conditions u sub infinity = o, under others u sub infinity is the unique solution of an appropriate limit equation associated with (V). A complete analysis is given as one special case of the boundedness and asymptotic properties of the solution of the above heat flow problem, under physically reasonable assumption concerning the relaxation functions, the nonlinear operator, the initial temperature distribution, and the external heat supply. R.C.T.

N80-31114# Naval Postgraduate School, Monterey, Calif.

CLASSIFICATION TECHNIQUES FOR MULTIVARIATE DATA ANALYSIS M.S. Thesis

Jin Ki Lee 28 Mar. 1980 121 p refs
(AD-A086521) Avail: NTIS HC A06/MF A01 CSCL 12/1

The multivariate analysis techniques of cluster analysis, principal components analysis, and discriminant analysis are examined in this thesis. The theory and applications of each of the techniques are discussed. Computer software available at the Naval Postgraduate School is discussed and sample jobs are included. A hierarchical cluster analysis algorithm, available in the IMSL software package, is applied to a set of data extracted from a group of subjects for the purpose of partitioning a collection of 26 attributes of a weapon system into six clusters of superattributes. A nonhierarchical clustering procedure, principal components analysis, and discriminant analysis were all applied to a collection of data on tanks consisting of twenty-four observations of ten attributes of tanks. The cluster analysis shows that the tanks cluster somewhat naturally by nationality. The principal components analysis and the discriminant analysis show that tank weight is the single most important discriminator among nationality. GRA

N80-31115# Naval Ocean Systems Center, San Diego, Calif.

TWO'S-COMPLEMENT FIXED-POINT MULTIPLICATION ERRORS. THEORY Final Report, May 1975 - Sep. 1979

L. P. Mulcahy 1 Apr. 1980 60 p refs
(AD-A085826; NOSC/TR-538) Avail: NTIS
HC A04/MF A01 CSCL 12/1

Analytic forms of a variety of two's-complement multiplication error statistics are derived. An FIR filter structure is used to define the individual error statistics which are used in the calculation of the filter output variance and spectrum. The approach used in deriving the statistics is to show that a regularity exists in the structure of the errors as the multiplier input is stepped through a series of consecutive values. The error structure is a function of coefficient value, number representation, and word lengths. This regular structure allows the use of the Poisson Summation Formula in deriving error statistics based on multiplier inputs obtained from quantized random variables. The error statistics are categorized according to families of coefficient values denoted by the parameter v. This parameter is the effective word length of the error. Specific forms of the statistics are given for Gaussian quantizer inputs. GRA

N80-31116# Michigan Univ., Ann Arbor. Dept. of Mathematics.

APPROXIMATION OF THE SPECTRUM OF CLOSED OPERATORS, THE DETERMINATION OF NORMAL MODES OF A ROTATING BASIN Interim Report

Mitchell Luskin, Jean Descloux (Ecole Polytechnique Federale de Lavsanne), and Jacques Rappaz (Ecole Polytechnique, Palaiseav, France) Mar. 1980 45 p refs Submitted for publication
(Contract F49620-79-C-0149; AF Proj. 2304)
(AD-A086661; AFOSR-TR-80-0548) Avail: NTIS
HC A03/MF A01 CSCL 12/1

This paper gives a theory of spectral approximation for closed operators in Banach spaces. The perturbation theory developed in this paper is applied to the study of a finite element procedure for approximating the spectral properties of a differential system modeling a fluid in a rotating basin. GRA

N80-31117# Naval Research Lab., Washington, D. C. Plasma Physics Div.

A NON-RECURSIVE INCOMPLETE CHOLESKY DECOMPOSITION METHOD FOR THE SOLUTION OF LINEAR EQUATIONS WITH A SPARSE MATRIX

A. Hain 16 Jun. 1980 26 p refs
(AD-A087005; AD-E000482; NRL-MR-4264) Avail: NTIS
HC A03/MF A01 CSCL 12/1

The incomplete Cholesky decomposition and the subsequent iterative solution by the conjugate gradient method has been described recently by D. Kershaw. The drawback of a triangular decomposition on a vector machine is the need for recursive computations. This paper proposes a method which eliminates the need for recursive computations. They are replaced by a number of non-recursive operations. This method can be utilized in the solution of potential equations in late time electrostatic codes. GRA

N80-31118# Arizona Univ., Tucson. Program in Applied Mathematics.

A SINGULAR PERTURBATIONS APPROACH TO REDUCED-

ORDER MODELING AND DECOUPLING FOR LARGE SCALE LINEAR SYSTEMS
Robert E. OMalley, Jr. Jul. 1980 11 p refs
(Contract N00014-76-C-0326; NR Proj. 041-466)
(AD-A087050; Rept-28) Avail: NTIS HC A02/MF A01 CSCL 12/1

This tutorial presentation introduces the two-time-scale concept and applies it to provide approximate solutions to initial value problems for large scale linear systems. GRA

N80-31119# Arizona Univ., Tucson. Program in Applied Mathematics.
ON MULTIPLE SOLUTIONS OF SINGULARLY PERTURBED SYSTEMS IN THE CONDITIONALLY STABLE CASE
Robert E. OMalley, Jr. Jul. 1980 23 p refs Presented at the Adv. Seminar on Singular Perturbations and Asymptotics, Madison, Wis., 28-30 May 1980 Sponsored in part by AFOSR, Army Research Office and NSF
(Contract N00014-76-C-0326; NR Proj. 041-466)
(AD-A087049; Rept-29) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper seeks the asymptotic behavior of solutions to nonlinear singularly perturbed boundary value problems for ordinary differential equations. Presuming a Jacobian matrix has a fixed number of (strictly) stable and unstable eigenvalues, the limiting solution can often be obtained from a reduced problem. Boundary layer behavior will satisfy a conditionally stable system, and multiple solutions will often result. The asymptotic structure of solutions is helpful in developing numerical solution schemes, and is vital in various applications (including some optimal control problems). GRA

N80-31120# Colorado State Univ., Fort Collins. Dept. of Statistics.
EXACT TWO-SIDED CONFIDENCE INTERVALS ON NONNEGATIVE LINEAR COMBINATION OF VARIANCE
Franklin A. Graybill and Chih-Ming Wang (SPSS, Inc.) 1 Jul. 1980 20 p refs
(Contract N00014-78-C-0463; NR Proj. 042-402)
(AD-A087052; TR-4) Avail: NTIS HC A02/MF A01 CSCL 12/1

A method is presented for obtaining two sided confidence intervals on a nonnegative linear combination of two variances and the confidence coefficient is 'exact' (equal to a specified value 1-alpha). GRA

N80-31121# Kentucky Univ., Lexington. Dept. of Electrical Engineering.
MATRIX METHODS FOR DETERMINING SYSTEM POLES FROM TRANSIENT RESPONSE. Electromagnetics Research Report, 1 Sep. 1978 - 30 Apr. 1979
T. L. Henderson May 1980 55 p refs
(Contract N00014-77-C-0362)
(AD-A087204; RR-80-1) Avail: NTIS HC A04/MF A01 CSCL 12/1

The problem treated is that of identifying the poles of a finite order system by observing its transient decay after cessation of input, for a limited time, using (possibly) multiple observation points and experimental repetition. Various approaches are studied, having the common characteristic that a homogeneous matrix equation must be solved. Several techniques that have been given scant attention in the literature are consolidated into the treatment, together with new results including an analytical treatment of the consequences of assuming an excessively high system order, derivation of a statistically unbiased estimate for an intermediate parameter in the solution, new theorems on error effects, a recipe for effective use of the singular value decomposition, a new method for suppression of extraneous poles, an elucidating derivation and extension of the method of Jain, a new form of the problem wherein the system poles are eigenvalues, and a study of the relationship between various pole identification methods. GRA

N80-31122# Pennsylvania State Univ., University Park. Applied Research Lab.
WAVES, CAUSTICS AND THOM'S THEOREM Ph.D. Thesis
Arthur Daniel Gorman 5 Mar. 1980 90 p refs
(Contract N00024-79-C-6043)
(AD-A086974; ARL-PSU-TM-80-26) Avail: NTIS HC A05/MF A01 CSCL 12/1

The technique of Maslov for determining the first term in the asymptotic series solution of linear partial differential equation is extended to determine the full asymptotic series solution of the reduced Helmholtz equation for scalar waves propagated in an inhomogeneous medium. The algorithm requires the characterization of the medium by a canonical phase function determined from a criterion derived from Thom's classification of singularities. GRA

N80-31123# Brookhaven National Lab., Upton, N. Y. Applied Mathematics Dept.
HIGH ORDER TIME SETTING METHODS FOR NONLINEAR EVALUATION EQUATIONS
Joseph E. Pasciak 1980 9 p refs Presented at 2nd Intern. Symp. on Innovative Numerical Analysis in Appl. Eng. Sci., Montreal, 16 Jun. 1980
(Contract EY-76-C-02-0016)
(BNL-27011; CONF-800625-1) Avail: NTIS HC A02/MF A01

How to derive high order time approximation procedures for certain nonlinear evolution equations based on a given high order approximation procedure for the homogeneous linear problem is demonstrated. For L a fixed differential operator, nonlinear evolution equations of the form u/sub t + Lu = J(u) are considered where J(u) is a nonlinear function of u. A stable and high order algorithm for approximating the linear problem v/sub t + Lv = 0 is assumed to be given. It is shown how to use the approximation algorithm to get high order approximation for the evaluation equation. The results of computational experiments are given which illustrate the benefits of the time stepping methods. The Korteweg-deVries equation and a nonlinear Schroedinger equation are considered. The spatial discretization is given by the spectral method with trigonometric polynomials (Fourier method). DOE

N80-31124# IBM Watson Research Center, Yorktown Heights, N.Y.
CONVENTIONS AND FORMULAS FOR USING THE MUELLER-STOKES CALCULUS IN ELLIPSOMETRY
P. S. Hauge, R. H. Muller, and C. G. Smith Dec. 1979 40 p refs Presented at the 4th Intern. Conf. on Ellipsometry, Berkeley, Calif., 20 Aug. 1979 Prepared in cooperation with Lawrence Berkeley Lab., Calif. and Bell Telephone Lab., Murray Hill, N.J.
(Contract W-7405-eng-48)
(LBL-10172; CONF-790857-3) Avail: NTIS HC A03/MF A01

A sign convention is proposed which specifies the ellipticity angle and the fourth Stokes parameter to be positive when the tip of the instantaneous electric field vector describes a right handed helix in space. Polarization of this type is designed as right handed and represented by a point on the northern half of the Poincare sphere. The consequences of using this convention, along with the previously adopted e/sup i(wt + delta)/ convention for the electric field, are seen in the relation among several representations of polarization state. These include the magnitudes and phases of the electric field components, the Jones vector, coherency matrix, Stokes parameters, Poincare sphere, polarization ratio, ellipsometric parameters psi and delta, and the azimuth and ellipticity of the polarization ellipse. The formalism for converting the Jones matrix into the matrix that transforms the coherency vector or the Stokes vector (Mueller matrix) is described. Mueller matrices for a linear retarder and an isotropic reflecting surface and the description of a compensator analyzer polarimeter are given. DOE

N80-31125# Knolls Atomic Power Lab., Schenectady, N. Y.
HIGH-ORDER CURVED FINITE ELEMENTS
E. L. Wachspress Mar. 1980 24 p refs Presented at the Symp. on Finite Elements, Storrs, Conn., 2 May 1980
(Contract DE-AC12-76SN-00052)
(KAPL-4134; CONF-800537-1) Avail: NTIS HC A02/MF A01

Recent finite element analysis of adaptive refinement focused attention on high order approximation within elements. High order approximation may be attained over curved elements with either

rational basis functions expressed directly in the global coordinates or with a particular class of isoparametric basis functions. Theory for construction of high order rational bases yields modification to the blending method for a spectral class of elements in order to achieve higher order approximation within these elements.
DOE

N80-31126# Montpellier Univ. (France). Dept. de Physique Mathematique.
ON SOME SPECTRAL PROBLEMS AND ISOSPECTRAL EVOLUTIONS CONNECTED WITH THE CLASSICAL STRING PROBLEM. PART 1: CONSTANTS OF MOTION
Pierre C. Sabatier Jul. 1979 9 p refs 2 Vol.
(PM/79/19-Pt-1) Avail: NTIS HC A02/MF A01
For some spectral problems that are associated with the classical string problem, it is shown that one spectrum completely determines the values of certain functionals. If the N first eigenvalues are known, these functionals are minimal for degenerate densities made of a finite number of heavy points.
Author (ESA)

N80-31127# Universite des Sciences et Techniques du Languedoc, Montpellier (France). Dept. de Physique Mathematique.
ON SOME SPECTRAL PROBLEMS AND ISOSPECTRAL EVOLUTIONS CONNECTED WITH THE CLASSICAL STRING PROBLEM. PART 2: EVOLUTION EQUATION
Pierre C. Sabatier Jul. 1979 6 p refs 2 Vol.
(PM/79/20-Pt-2) Avail: NTIS HC A02/MF A01
The evolution equations associated with the singular string problem that can be derived from the operator are studied. Results show that given certain assumptions, the spectral problem is equivalent to the one dimensional Schroedinger problem, the discrete spectrum corresponding to bound states, the continuous one to scattering.
Author (ESA)

N80-31128# Universite des Sciences et Techniques du Languedoc, Montpellier (France). Dept. de Physique Mathematique.
SOME COMMENTS ON THE RATIONAL SOLUTIONS OF THE ZAKHAROV-SCHABAT EQUATIONS
V. B. Matveev 1979 13 p refs
Avail: NTIS HC A02/MF A01
A family of the rational solutions of the Zakharov-Schabat equations is described. This family is characterized by an extremely simple superposition principle which follows directly from the Darboux-invariance of the Zakharov-Schabat equations. An infinite sequence of polynomials P sub n (x, y, t, t sub 4,..., t sub m), m < or = n, is presented so that the developed formula will represent some class of solutions of the Kadomtcev-Petviashvily (K-P) equation. The parameters t sub 4,..., t sub K represent the explicit action of the commuting flows, related with the Zakharov-Schabat operators of the higher order, on the solutions of the K-P equation and can be fixed independently in each P sub i. The polynomials P sub n are closely related with the second Waring formula. This relation imposes some specific constraints on the motion of the n particle Moser-Calodgero system generated by P sub n.
Author (ESA)

N80-31129# Goeteborg Univ. (Sweden). Dept. of Mathematics.
OCCURRENCES IN A BRANCHING PROCESS
Martin Haernqvist 1979 83 p refs
Avail: NTIS HC A05/MF A01
With general convergence theory for branching processes as a basis, two special problems are investigated. In one situation, an extra point process of events during life is assigned to each realized individual and the behavior of the superposition of such point processes in action is studied as the population grows. With the proper scaling and under some regularity conditions the superposition is shown to converge in distribution to a Poisson process. One implication of this result is that the collection of death moments of individuals has an asymptotic Poisson description. In the second situation, rare events among the individuals in the special Bellman-Harris branching process are studied. It is shown that the point process of occurrences of a certain event that may concern life or reproduction of the individual in the population has a mixed Poisson limit as the probability of the event tends to zero. Estatblished weak convergence techniques for point processes are applied. Some recent strong convergence theorems for branching processes are also used. Finally, a result on the asymptotics of the maximal age among existing individuals is derived.
Author (ESA)

N80-31130# Goeteborg Univ. (Sweden). Dept. of Mathematics.
STUDIES OF STABILITY IN APPLIED MATHEMATICS Thesis
Ingvar Mellander 1979 13 p refs
(ISBN-91-7222-268-9) Avail: NTIS HC A02/MF A01
The asumptotic behavior of the solutions to two nonlinear systems of ordinary differential equations were studied. One of them is a deterministic model for infectious diseases which extends the model by Lajmanovich and Yorke since seasonal variations are allowed. The other system is a model for certain deposition processes. The periodic case of both systems was investigated.
Author (ESA)

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N80-31131# North Carolina Univ. at Chapel Hill.
ANTITHETIC VARIATES REVISITED
George S. Fishman and BaoSheng D. Huang Jun. 1980 40 p refs
(Contract N00014-76-C-0302)
(AD-A086114; TR-80-4) Avail: NTIS HC A03/MF A01 CSCL 12/1
This paper extends earlier results in the area of variance reduction techniques applied to simulation on a computer. In particular, it views the antithetic sampling technique as a combination of rotation and reflection sampling on a circle. The covariance structures induced by the techniques separately and together are derived and conditions under which they are optimal sampling plans are described. Rates of convergence for the variance of the sample mean are given for bounded, continuous and discrete random variables and for unbounded continuous random variables with special, although commonly encountered, structure.
GRA

N80-31132# Maryland Univ., College Park. Computer Science Center.
COMPUTER ERROR BOUNDS FOR AGGREGATED MARKOV CHAIN
G. W. Stewart May 1980 33 p refs
(Contract N00014-76-C-0391)
(AD-A086193; TR-901) Avail: NTIS HC A03/MF A01 CSCL 12/1
This paper describes a method for computing the steady state probability vector of a nearly completely decomposable Markov chain. The method is closely related to one proposed by Simon and Ando and developed by Courtois. However, the method described here does not require the determination of a completely decomposable stochastic approximation to the transition matrix and hence it is applicable to matrices other than stochastic. An error analysis of the procedure is given which results in effectively computable error bounds.
GRA

N80-31133# Temple Univ., Philadelphia, Pa. Dept. of Mathematics.
FAILURE TIME DISTRIBUTIONS: ESTIMATES AND ASYMPTOTOC RESULTS Interim Report
Janos Galambos 1980 24 p refs
(Grant AF-AFOSR-3504-78; AF Proj. 2304)
(AD-A086828; AFOSR-80-0515TR) Avail: NTIS HC A02/MF A01 CSCL 12/1
The paper deals with life distributions for coherent systems of components. Two major questions are discussed: (1) estimation of system life from data, or knowledge, on component lives, and (2) asymptotic models. Both questions are related to extremes of a sequence of random variables through the path set and cut set decomposition of coherent systems, which reduce a

coherent system to either a parallel or series system. Since for these decompositions, the classical theory of extremes of independent and identically distributed random variables does not provide an acceptable approximation, the emphasis is on dependent random variables, or when the random variables are not identically distributed. The inequalities presented when discussing question (ii) above are applicable not only to extreme value problems but to an arbitrary multivariate distribution using lower dimensional marginals. The asymptotic models are discussed in the light of hazard rate properties of the limiting distributions of the models. A parametric family of distributions is proposed for approximating life distributions whose hazard rate is bath-tub shaped, this representing a burn-in period, an accidental failure period and a wear-out period. GRA

N80-31134# Naval Postgraduate School, Monterey, Calif.
A STUDY OF THE PROPERTIES OF A NEW GOODNESS-OF-FIT TEST Technical Report, Jan. - Mar. 1980
Richard Franke and Toke Jayachandran 1 May 1980 95 p refs
(RR000011O)
(AD-A086563; NPSS3-80-003) Avail: NTIS HC A05/MF A01 CSCL 12/1

We investigate the power properties of a new goodness-of-fit test proposed by Foutz (1980). This new test is compared with the Chi squared test and the Kolmogorov-Smirnov (K-S) test for normality when the samples come from (1) the family of asymmetric stable distributions, (2) mixture of normal distributions, and (3) the Pearson family. The general conclusion is that the new test performs better than the Chi squared and the K-S test when the parent distribution is heavy tailed. If the hypothesized distribution differs from the true distribution in location only, the new test does not do as well as the other two. GRA

N80-31135# California Univ., Berkeley. Operations Research Center.
PREPOSTERIOR ANALYSIS OF BAYES ESTIMATORS OF MEAN LIFE, 1
Richard E. Barlow and Alexander S. Wu Feb. 1980 26 p refs
(AD-A086771; ORC-80-4) Avail: NTIS HC A03/MF A01 CSCL 12/1

In considering life test experiments from a behavioristic Bayes point of view, we may speculate on the effect of model misspecification on the posterior mean under alternative stopping rules. Of course, under the life distribution model, we expect the mean of the posterior to equal the mean of the prior. However, if we think the model may have been misspecified, we would no longer expect this equality. We show that for Bayes estimators of mean life under the exponential model and general priors on mean life, we expect, based on a preposterior analysis, that the mean of the posterior will increase with sample size when the true model has an increasing failure rate and certain fixed stopping rules are used. Also, we show that for Bayes estimators of mean life based on the natural conjugate prior for the exponential model and complete samples, the Bayes risk is less when the coefficient of variations is less than for the exponential model. Recommendations relative to use of life test sampling plans based on an exponential model are made. GRA

N80-31136# Wisconsin Univ. - Madison. Mathematics Research Center.
CUMULATIVE PROCESSES: LINEAR COMBINATIONS OF ORDER STATISTICS AND PERCENTILES
Sue Leurgans Mar. 1980 33 p refs
(Contract DAAG29-75-C-0024; Grants NSF MCS-78-09525; NSF MCS-77-16974)
(AD-A086372; MRC-TSR-2056) Avail: NTIS HC A03/MF A01 CSCL 12/1

Percentiles and linear combinations of order statistics are statistics which are sometimes preferred to averages because they can be less sensitive to the presence of a few wild observations. It is well known that for large samples, both percentiles and linear combinations of order statistics resemble averages in that the appropriately normalized statistic is approximately normally distributed, with parameters which depend on the underlying distributions. This paper shows that percentiles and linear combinations of order statistics resemble averages in a stronger sense. It is well known that if a sequence of averages is plotted against the number of observations contributing to the average, and the resulting plot is rescaled appropriately, then for long sequences the picture will act like a realization of a Brownian motion path. This paper establishes that this is still true if the averages are replaced by percentiles or by linear combinations of order statistics. GRA

N80-31137# Wisconsin Univ. - Madison. Mathematics Research Center.
MEASURES OF LACK OF FIT, AND TRANSPORTATION OF PREDICTORS IN COMPOSITE DESIGNS
G. E. P. Box and N. R. Draper May 1980 24 p refs
(Contracts DAAG29-75-C-0024; DAAG29-80-C-0041)
(AD-A086562; MRC-TSR-2077; UWIS-DS-80-603) Avail: NTIS HC A02/MF A01 CSCL 12/1

The central composite designs are investigated in terms of their ability to detect lack of fit and it is shown that measures of nonquadraticity can be obtained in all the k major directions. The geometrical interpretation of this is explained. The relationship of these lack of fit measures to the estimation of power transformations in the predictor variables is also explored. GRA

N80-31138# Michigan State Univ., East Lansing. Dept. of Statistics and Probability.
CONVERGENCE OF PROGRESSIVELY CENSORED LIKELIHOOD RATIO PROCESSES IN LIFE-TESTING
Joseph C. Gardiner Jun. 1980 19 p refs
(Contract N00014-79-C-0522; Grant BRSG-S07-RR07049-14)
(AD-A087057; RM-391) Avail: NTIS HC A02/MF A01 CSCL 12/1

The weak convergence of certain (randomly stopped) likelihood ratio processes based on the ordered observations corresponding to a random sample is considered in the situation where the hazard rate function of the underlying distribution is separable in its variables. It is shown that under mild conditions on the stopping variables the log likelihood function is locally asymptotically normal. Some remarks pertaining to the general ease and applications of the theorems proved are also discussed. GRA

N80-31139# Iowa Univ., Iowa City. Dept. of Statistics.
BOUNDS ON MIXTURES OF DISTRIBUTIONS ARISING IN ORDER RESTRICTED INFERENCE
Tim Robertson and F. T. Wright 10 Jul. 1980 22 p refs
Prepared in cooperation with Missouri Univ., Rolla
(Contracts N00014-80-C-0322; N00014-80-C-0321)
(AD-A087117) Avail: NTIS HC A02/MF A01 CSCL 12/1

In testing hypotheses involving order restrictions on a collection of parameters, distributions arise which are mixtures of standard distributions. Since tractable expressions for the mixing proportions do not, in general, exist even for parameter collections of moderate size, the implementation of these tests may be difficult. It is not necessary to bound the individual mixing proportions in order to obtain a bound for the tail probabilities of the 'mixed' distributions. Bounds for such tail probabilities are derived and their application to several order restricted hypothesis testing situations is discussed. These results are also applied to obtain the least favorable configuration in a two sample likelihood ratio test of the equality of two multinomial populations versus a stochastic ordering alternative. GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N80-31140 Johns Hopkins Univ., Baltimore, Md.
MINIMIZING THE COST OF OPERATING AIRCRAFT ON MULTISTOP TOURS Ph.D. Thesis
Norman Babcock Waite 1980 130 p
Avail: Univ. Microfilms Order No. 8020260

An operationally practical means of informing the pilot on operational decisions during a multistop tour in order to complete the tour feasibly and at minimum expected cost is presented.

The minimum is in the following sense: no means of flying the tour where decisions are made using information available up to the time each decision is made can do better. Optimality is proved. Computational experience and results are included.
Dissert. Abstr.

N80-31141# Illinois Univ., Chicago. Dept. of Mathematics.
STUDY OF OPTIMALITY CRITERIA IN DESIGN OF EXPERIMENTS Interim Report
A. Hedayat 3 Jun. 1980 33 p refs Presented at the Intern. Symp. on Statistics and Related Topics, Ottawa, 5-8 May 1980
(Grant AF-AFOSR-3050-79; AF Proj. 2304)
(AD-A086830; AFOSR-80-0514TR) Avail: NTIS HC A03/MF A01 CSCL 12/2

This paper rigorously studied various optimality criteria currently adopted by design specialists in choosing a best design for performing an experiment. These optimality criteria includes: G-optimality, D-optimality, L-optimality, E-optimality, S-optimality, (M,S)-optimality, PHI sub p-criteria, Universal optimality, type 1 and 2 criteria and Schur optimality. GRA

N80-31142# Army Military Personnel Center, Alexandria, Va.
MULTIPLE OBJECTIVES AND THE PATH DETERMINATION PROBLEM M.S. Thesis. Final Report
J. E. Thomas, Jr. 3 Jul. 1980 91 p refs
(AD-A086744) Avail: NTIS HC A05/MF A01 CSCL 12/2

The shortests path problem exists as a major component of many network problems. For problems with a single objective, algorithms developed over the past twenty-five years have made the solution of this problem a relatively simple exercise. For multiobjective problems, adaptation of shortest path methodologies to generate noninferior solutions is a complex and difficult task. This thesis introduces an algorithm, based on label-correcting algorithmic techniques, which identifies all noninferior paths from one node in a network to all other nodes in the network in a single computer run. The algorithm, titled the Noninferior Path Labeling Algorithm (NPLA), is shown to be at least four to ten times faster than shortest path labeling algorithms applied multiobjectively for a problem with two objectives. NPLA is judged to be unique in its capability to identify all solutions which lie in duality gaps of the noninferior solution set. NPLA has been found to be easily programmed, efficient, and capable of being used with all network designs. It is readily adaptable to problems of more than two objectives. GRA

N80-31143# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
DECENTRALIZED ALGORITHMS FOR OPTIMIZATION OF SINGLE COMMODITY FLOWS M.S. Thesis
Isidro Marcos Castineyra Figueredo Jun. 1980 64 p refs
(Contract N00014-75-C-1183; ARPA Order 3045)
(AD-A086736; LIDS-TH-999) Copyright. Avail: NTIS HC A04/MF A01 CSCL 12/2

Message routing was studied in a data communication network in which all messages are addressed to the same node of the network. We approach this problem by the minimization of a linear, increasing function of the message flow in the links of the network. In this minimization we consider explicitly the capacities of the links. We present two algorithms which can be executed in a distributed manner, i.e. the data processing facilities at the nodes of the network cooperate in this minimization by interchanging messages and processing them. One of the algorithms is an adaptation of the primal simplex method of linear programming. The other is an adaptation of D. R. Fulkerson's 'out-of-kilter' algorithm. We give simulation results of the performance of the first algorithm, and a bound on the total number of messages required by the second algorithm. GRA

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N80-31144 Cornell Univ., Ithaca, N. Y.
EULER MANIFOLDS AND STIEFEL-WHITNEY HOMOLOGY CLASSES Ph.D. Thesis
Darko Veljan 1979 98 p
Avail: Univ. Microfilms Order No. 8020898

The geometry of Euler manifolds is investigated systematically. Basic properties of Stiefel-Whitney homology classes (combinatorially defined) on Euler manifolds mod 2 are established, and a system of axioms for these classes is given. As a byproduct of this axiomatic description it is shown that the Stiefel-Whitney classes on compact Euler manifolds mod 2 which satisfy mod 2 Poincare duality are homotopy invariants. This is shown by proving that Stiefel conjecture is valid on this class of spaces. The main tools in proving the uniqueness of the axioms are block bundle transversalities and an interpretation of cohomology classes as certain morphisms on bordism groups into the group of coefficients. Dissert. Abstr.

N80-31145 Memphis State Univ., Tenn.
BANACH SPACE SHIFT OPERATORS Ph.D. Thesis
James Earl Robinson 1980 111 p
Avail: Univ. Microfilms Order No. 8020390

Various kinds of shift operators which have been defined on Banach space are investigated along with the interrelationships that exist among these classes of operators. Of particular interest is the connection between Crownover shifts and Gellar Schauder basis shifts. Different kinds of Schauder bases on Banach space are studied. The orthogonality of bases as given through several distinct interpretations are considered. Normal bases, monotone bases, and orthogonal bases are compared. A kind of reverse monotone condition is imposed on a basis to determine its relationship to the other definitions. A necessary and sufficient condition for a Crownover shift on a reflexive space to be a Gellar Schauder basis shift and a technique for approximating Gellar Schauder basis shifts with Crownover shifts on certain spaces are developed. Dissert. Abstr.

N80-31146*# Massachusetts Inst. of Tech., Cambridge. Lab for Information and Decision Systems.
LINEAR STATE FEEDBACK, QUADRATIC WEIGHTS, AND CLOSED LOOP EIGENSTRUCTURES M.S. Thesis. Final Report
Peter Murray Thompson Sep. 1980 101 p refs
(Grant NsG-1553)
(NASA-CR-163484; LIDS-FR-1029) Avail: NTIS HC A06/MF A01 CSCL 12A

Equations are derived for the angles of general multivariable root loci and linear quadratic optimal root loci, including angles of departure and approach. The generalized eigenvalue problem is used to compute angles of approach. Equations are also derived to find the sensitivity of closed loop eigenvalue and the directional derivatives of closed loop eigenvectors. An equivalence class of quadratic weights that produce the same asymptotic eigenstructure is defined, a canonical element is defined, and an algorithm to find it is given. The behavior of the optimal root locus in the nonasymptotic region is shown to be different for quadratic weights with the same asymptotic properties. An algorithm is presented that can be used to select a feedback gain matrix for the linear state feedback problem which produces a specified asymptotic eigenstructure. Another algorithm is given to compute the asymptotic eigenstructure properties inherent in a given set of quadratic weights. Finally, it is shown that optimal root loci for nongeneric problems can be approximated by generic ones in the nonasymptotic region.
L.F.M.

N80-31147# Columbia Univ., New York. Dept. of Computer Science.
ON THE OPTIMAL SOLUTION OF LARGE LINEAR SYSTEMS
J. F. Traub and H. Nozniakowski Jan. 1980 74 p refs
(Contract N00014-76-C-0037; Grant NSF MCS-78-23676)
(AD-A086349) Avail: NTIS HC A04/MF A01 CSCL 12/1

We investigate the minimal number of matrix-vector multiplications to approximately solve a linear system. The minimal number of multiplications depends on the properties of a class of problems such as symmetry, positive definiteness, and bound on condition number. For different classes of problems we obtain the minimum exactly or almost exactly and establish with algorithms are optimal, that is, attain the minimum. Furthermore, we obtain quantitative results on how the lack of certain properties increases the minimum. GRA

N80-31148# Wisconsin Univ. - Madison. Mathematics Research Center.
DICHOTOMIES FOR BAND MATRICES
Carl deBoor Mar. 1980 27 p refs
(Contract DAAG29-75-C-0024)
(AD-A086373; MCR-TSR-2057) Avail: NTIS
HC A03/MF A01 CSCL 12/1

Spline approximation is often most effective when the breakpoint (knot) sequence can be chosen suitably nonuniform. At the same time, standard spline approximation schemes (such as least-squares approximation by splines) are so far only known to be bounded as long as the breakpoint sequence is almost uniform. Any such bound is obtained (explicitly or implicitly) in terms of a bound on the inverse of certain matrices which are banded. Any attempt at establishing bounds for more general breakpoint sequences must therefore come to grips with the inverses of these band matrices. The hope is that Demko's discovery of the exponential decay of band matrix inverses will lead eventually to those desired bounds. GRA

N80-31149# Wisconsin Univ. - Madison. Mathematics Research Center.
NOTES ON GENERALIZED BOUNDARY VALUE PROBLEMS BANACH SPACES
R. C. Brown (Alabama Univ., University) Mar. 1980 40 p refs
(Contract DAAG29-75-C-0024)
(AD-A086371; MRC-TSR-2055) Avail: NTIS
HC A03/MF A01 CSCL 12/1

Multipoint boundary conditions arise in the theory of beams or plates with interior point loads, and also the mathematical theory of splines. Interface conditions arise in problems of diffusion through parallel 'slabs' with different properties (e.g., nuclear reactors or the study of shock waves). Adjoints of such differential operators also are encountered when one attempts to derive Euler-Lagrange equations for constrained minimization problems. Our method is very general and is designed to work for partial differential, integral and functional differential operators as well as differential operators. Part 1 presents some of the abstract machinery to solve the problem. Part 2 will apply this machinery to concrete and applied problems of the type mentioned above. GRA

N80-31150# Wisconsin Univ. - Madison. Mathematics Research Center.
WHAT IS THE MAIN DIAGONAL OF A BIINFINITE BAND MATRIX?
Carl deBoor Mar. 1980 17 p refs
(Contract DAAG29-75-C-0024)
(AD-A086366; MRC-TSR-2049) Avail: NTIS
HC A02/MF A01 CSCL 12/1

How to single out a particular diagonal of a biinfinite band matrix A as its main diagonal, using the decomposition of the solution set of Ax = 0 into those which are bounded at infinity and those which are bounded at - infinity is shown. As an application, it is proved that the inverse of the coefficient matrix for the system satisfied by the B-splines coefficients of the cubic spline interpolant at knots is checkerboard and that, under certain assumptions, the local mesh ratio must be bounded. M.G.

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N80-31151# Oak Ridge National Lab., Tenn. Fusion Energy Div.
STATUS OF THE STRUCTURAL DESIGN OF SUPERCONDUCTING MAGNETS FOR THE LARGE COIL PROGRAM
W. H. Gray and C. J. Long 1979 6 p refs Presented at 8th Symp. on Eng. Probl. of Fusion Res., San Francioco, 13 Nov. 1979
(Contract W-7405-eng-26)
(CONF-791102-160) Avail: NTIS HC A02/MF A01

The status of the structural designs, analysis methods, and verification tests being performed by the participating Large Coil Program design teams is reviewed. The significant structural mechanics concerns being investigated are presented. DOE

N80-31152# Los Alamos Scientific Lab., N. Mex.
MEASUREMENTS OF ELECTRON HEAT FLOW ALONG A dc MAGNETIC FIELD IN STRONG TEMPERATURE GRADIENTS
R. S. Massey, J. C. Ingraham, B. L. Wright, and H. Dreicer 1980 11 p refs Presented at the Inter. Symp. on Phys. and Open-Ended Fusion Systems, Tsukuba, Japan, 15 Apr. 1980
(Contract W-7405-eng-36)
(LA-UR-80-1109; CONF-800441) Avail: NTIS
HC A02/MF A01

Measurements of electron heat flow parallel to B are performed on fully-ionized quiescent plasma column under conditions for which the electron-electron collisional mean free path, 1/sub ee/, is not small relative to the electron temperature-gradient scale-length. Pulsed microwave heating at one location on the column and nonperturbing microwave resonator measurements of temperature at two locations on the column are used to create and to measure the heat flow. Results are compared with the predictions of a 1-D heat diffusion code that has a parameter, alpha, multiplying the Spitzer heat conductivity coefficient, and that also has provision for limiting the heat flux to q/sub L = beta nkT square root of kt/m (where beta is an adjustable parameter) in order to model the transition to larger values of (1/sub ee/T)dT/dx/. DOE

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N80-31153 Washington Univ., Seattle.
COCHLEAR MICROPHONIC EVIDENCE FOR MECHANICAL PROPAGATION OF DISTORTION PRODUCTS (f2-f1) AND (2f1-f2) Ph.D. Thesis
Gary Lee Gibian 1980 150 p
Avail: Univ. Microfilms Order No. 8018729

Cochlear microphonic (CM) data were obtained from the second and third turns of the chinchilla cochlea. Fluid-filled glass micropipettes were used to record from scala media, and nichrome wire electrodes were used to record differentially between scala vestibuli and scala tympani. Validity of our results is supported in part by the sensitivity and sharp tuning of the CM and, in the case of the scala media recordings, by the presence of a normal DC endolymphatic potential. It was observed, with sound pressure levels (SPL) as low as 25 dB, that these distortion products in CM display tuning similar to the single-tone response. The tuning similarities observed in the present CM study are consistent with previous neural studies. From these tuning similarities, it is concluded that our CM data reflect the presence of mechanically propagated distortion products at low SPLs. Dissert. Abstr.

N80-31154 Catholic Univ. of America, Washington, D.C.
ARRAY GAIN IMPROVEMENT BY SELECTIVE SENSOR EXCLUSION Ph.D. Thesis
Louis Allen Mole 1980 181 p
Avail: Univ. Microfilms Order No. 8018808

The application of the sensor exclusion criteria to real experimental data provides array gain improvement probabilities which compare favorably with the model's calculated values and, in addition, indicate the levels of expected improvement. Specifically, three selected sensor exclusion criteria values are used to process two data sets to indicate their effect on the array gain results. For one data set, the processing results demonstrate average and peak improvement values as great as 2 and 9.5 dB, respectively, whereas, for the second set, these values were as great as 7 and 11.5 dB, respectively. Correspondingly the probability that the application of the criteria will provide array gain improvement varied between 17 and 64 percent for the first data set and between 34 and 92 percent for the second. The results of the study conclusively indicate that selective sensor exclusion criteria may be formulated and

implemented so as to improve array performance and increase array gain. Dissert. Abstr.

N80-31155# Army Construction Engineering Research Lab., Champaign, Ill.
THE BLAST NOISE PREDICTION PROGRAM: USER REFERENCE MANUAL Interim Report
V. Pawlowska and L. Little Aug. 1979 78 p refs
(CERL-IR-N-75) Avail: NTIS HC A05/MF A01

User instructions for the Blast Noise Prediction computer program, BNOISE 1.0, which is designed to predict the noise impacts of Army blast noise operations are provided. A sample run and a list of module error messages are provided, along with a description of the manipulation of the modules used by the Blast Noise program. T.M.

N80-31156# Army Construction Engineering Research Lab., Champaign, Ill.
MITIGATION OF NOISE IMPACT VIA OPERATIONAL CHANGES Final Report
Richard Raspet Sep. 1979 23 p refs
(CERL-TR-N-76) Avail: NTIS HC A02/MF A01

Three case studies which can serve as a guide for using operational changes of artillery and demolition to reduce noise impacts at Army installations are presented. In each case study, the initial and final noise impact is documented by computer generated equal noise contours. Operational changes may be used to reduce the total area impacted, to reduce the noise level in a particular location, or to shift the impacted area away from the noise sensitive areas. R.K.G.

N80-31157# Naval Underwater Systems Center, New London, Conn. Office of Engineering Mechanics.
ANALYSIS OF SCATTERING AND RADIATION OF ACOUSTIC WAVES FROM AN AXISYMMETRIC STRUCTURE IN A INFINITE FLUID MEDIUM
Jayant S. Patel 27 Mar. 1980 52 p refs
(AD-A086587; NUSC-TR-5821) Avail: NTIS HC A04/MF A01 CSCL 20/1

Analysis of scattering and radiation of acoustic waves from an axisymmetric structure in an infinite fluid medium is presented. It is shown that the use of a basis function, consistent with the one used for axisymmetric pressure on the finite surface, yields accurate results and uses fewer finite surface elements than does piston-type analysis. GRA

N80-31158# General Electric Co., St. Petersburg, Fla. Neutron Devices Dept.
EVALUATION OF ULTRASONIC CLEANING SYSTEMS
T. J. Gillespie 1980 11 p Presented at the ACS Meeting-in-Miniature, Tampa, Fla., 8 May 1980
(Contract DE-AC04-76DP-00656)
(GEPP-OP-501; CONF-800538-3) Avail: NTIS HC A02/MF A01

Several methods, for evaluating ultrasonic cleaners were tested, including pencil marked ceramic, Al foil erosion, Branson cavin meter, etc. A method was devised which involves applying a thin metallize coating to a ceramic plate. This method was used to evaluate new ultrasonic cleaners. DOE

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N80-31159 Indiana Univ., Bloomington.
ANALYTIC APPROACHES TO ATOMIC RESPONSE PROPERTIES Ph.D. Thesis
Edward Eugene Lamm 1980 347 p
Avail: Univ. Microfilms Order No. 8016432

Analytic asymptotic theories of atomic response properties are constructed that yield results as accurate as those obtained by more elaborate numerical methods. A novel and simple method is used to determine the multipole sum rules S sub L (-k), for positive and negative values of k, of the hydrogen atom and the hydrogen negative ion in the asymptotic approximation. An analytically-tractable extended asymptotic model for the response properties of weakly-bound anions is proposed and the multipole polarizability, multipole sum rules, and photodetachment cross section determined by the model are computed analytically. Dipole polarizabilities and photodetachment cross sections determined from the model for Li-, Na-, and K- are compared with numerical results. Agreement is typically within 15 percent if the pseudopotential is included. A comprehensive and unified treatment of atomic multipole oscillator strengths, dynamic multipole polarizabilities, and dispersion force constants in a variety of Coulomb-like approximations is presented. Dissert. Abstr.

N80-31160 Delaware Univ., Newark.
A ZERO CORE-CONTRIBUTION MODEL FOR PHOTODETACHMENT OF ATOMIC AND MOLECULAR NEGATIVE IONS Ph.D. Thesis
Robert Merrell Stehman 1980 213 p
Avail: Univ. Microfilms Order No. 8019952

A simple model for computing photodetachment cross sections was developed. The model which represents a negative ion by an equivalent one electron system is simple to apply since only the asymptotic behavior of the electron's wave function is required. For atomic negative ions, only the orbital angular momentum, (lambda), of an electron in the outermost shell, the electron affinity and the atomic radius of the parent neutral atom need be known. Comparable information is required for molecular ions. This information is available for many ions from sources independent of photodetachment experiments. The model shows that atomic ions davide into groups according to their value of lambda. Within each group, ions have cross sections sharing common features, with the maximum cross sections being nearly proportional to the square of the atomic radii of the parent atoms. The model is applied to the homonuclear diatomic ions O2(-) and S2(-). In addition to computing the total photodetment cross section, the model gives information about detachment associated with single vibrational transitions. Dissert. Abstr.

N80-31161 Idaho Univ., Moscow.
ISOBAR PRODUCTION IN HEAVY ION COLLISIONS Ph.D. Thesis
Lawrence Willard Townsend 1980 113 p
Avail: Univ. Microfilms Order No. 8019796

The production of isobars with concomitant giant resonance excitations due to peripheral collisions of relativistic heavy ions is investigated. The interaction is described by a modified form of the one-pion exchange potential where the projectile ordinary spin operator is replaced by a transition spin operator which described the creation of an isobar from a nucleon. The scattering is analyzed using time-dependent harmonic perturbation theory to determine the reaction total cross sections. The results obtained are applied to the specific collision of 2.1 GeV/nucleon O-16 projectiles with C-12 targets at rest. Cross sections are investigated using two different models for the nuclear spin states. In the first, a single isobar is formed in the projectile while the target is excited to one of its isovector excited states near 15 MeV via the collective spin giant resonance mechanism. In the second, the target is excited to this same state again, and the projectile, by analogy, is assumed excited to a collective isobar giant resonance state. The calculations for the two reactions are repeated, with comparable results, for a nuclear spin model where the many-body spin states are described by unsymmetrized products of individual particle spins. Dissert. Abstr.

N80-31162 Michigan State Univ., East Lansing.
A HYDRODYNAMIC THEORY OF HEAVY ION COLLISIONS Ph.D. Thesis
David Carl Mundinger 1980 104 p
Avail: Univ. Microfilms Order No. 8020723

The dynamics of an interacting Fermi liquid formed the basis for a macroscopic description of heavy ion collisions. A computation was done, first of all, for the one dimensional case using a Lagrangian technique. The breakup threshold was calculated for the collision between two semi-infinite slabs of nuclear matter. This one dimensional model contains many of the features of heavy ion collisions. Based on these results a model was made for the collision between spherical nuclei. The degrees of freedom

that we emphasize are the centers of the two nuclei, and the location of two boundaries which separate the nuclear matter into a compressed region and two uncompressed regions. Using the equation of state, along with the conservation laws for mass and momentum, we can generate equations of motion for each of the dynamical variables. The momentum transport between the two nuclei is taken from the theory of a collisionless Fermi gas. Angular distributions, energy loss, and fusion cross sections have been studied. Dissert. Abstr.

N80-31163 California Univ., Riverside.
THEORETICAL STUDIES OF MOLECULAR COLLISION PROCESSES. 1: TWO-POTENTIAL APPROACH FOR ELECTRON-MOLECULAR SCATTERING. 2: THREE-DIMENSIONAL QUANTUM MECHANICAL STUDY ON ATOM-MOLECULE REACTIVE COLLISION WITH ROTATIONALLY PRE-EXCITED TARGET MOLECULE Ph.D. Thesis
James Cheng Sun 1980 293 p
Avail: Univ. Microfilms Order No. 8020622

Theoretical studies were carried out on two categories of molecular collision processes: (1) molecule scattering with a light incident particle-electron, and (2) molecule scattering with a heavy incident - particle atom. For the electron-molecule scattering, a two-potential approach was formulated for elastic and vibrational transitions with intermediate- and high-energy impact electrons. In this approach, contributions to the scattering process come from the incoherent sum of two dominant potentials: a short-range shielded nuclear Coulomb potential from individual atomic center, and a permanent/induced long-ranged potential. Applications to e-N2, e-C02 scatterings from 50-800 eV incident electron energy yielded good agreement with absolutely calibrated experiments. The three dimensional atom-molecule reactive collision was studied quantum-mechanically within the T-matrix formalism with the adiabetic approximation. Application to the D + H2 reaction on the ab initio Liu-Siegbahn- Truhlar--Horowitz surface was made. Scattering cross sections of the rotationally pre-excited target molecule are in general 2 to 3 times smaller than those of the ground state molecule. Dissert. Abstr.

N80-31164# Pittsburgh Univ., Pa. Dept. of Physics and Astronomy.
ATOMIC AND MOLECULAR PROCESSES Final Report, 1 Jul. 1977 - 15 May 1980
M. A. Biondi 25 Jun. 1980 6 p refs
(Contract N00014-76-C-0098; ARPA Order 2686)
(AD-A086764) Avail: NTIS HC A02/MF A01 CSCL 20/5

The topics investigated experimentally and theoretically by the Pittsburgh Atomic Sciences Institute with applications to high power laser development and atmospheric IR backgrounds are enumerated. Reports containing the detailed scientific progress in these studies are cited. Finally, a list of the journal articles describing the results of the programs, with full references, is given. GRA

N80-31165# California Univ., Santa Barbara. Dept. of Physics.
ENERGY TRANSFER AND OPTICAL SPECTROSCOPY OF DIATOMIC MOLECULES IN CHEMICALLY REACTING SYSTEMS Final Report, 1 Aug. 1976 - 31 Dec. 1979
H. P. Broida and David O. Harris Dec. 1979 8 p refs
(Grant AF-AFOSR-3138-77)
(AD-A086829; AFOSR-80-0540TR) Avail: NTIS HC A02/MF A01 CSCL 07/4

Increased capabilities in remote sensing, communication and several other areas depend on developments in laser technology. Chemical lasers indicate a high probability of fulfilling these needs through their properties of different wavelengths, high power, high operating efficiency and lower weight. Additionally, optically pumped metal dimers are attractive systems for visible, tunable gas lasers. The development of new improved chemical laser systems and optically pumped laser systems requires an increased understanding and knowledge of the properties and characteristics of candidate reactions and molecules. Detailed spectroscopic studies on both CuF and Ca2 have been carried out. Use of laser photoluminescence has produced spectroscopic information previously unobtainable. We have obtained improved molecular constants and dissociation energies, radiative lifetimes, and quenching cross-sections for electronically excited products. In addition previously unknown electronic states have been identified. GRA

N80-31166# Naval Surface Weapons Center, White Oak, Md. Research and Technology Dept.
ELECTRONIC STOPPING POWER CALCULATIONS FOR ALL HEAVY IONS AT LOW VELOCITY IN ALL ELEMENTS Final Report
J. G. Brennan and D. J. Land 17 Mar. 1980 65 p refs
(AD-A087107; NSWC/TR-80-89) Avail: NTIS HC A04/MF A01 CSCL 20/8

Values of the electronic stopping power for projectiles from carbon to uranium in elemental targets from hydrogen through the transuranic elements at the Bohr velocity, are presented in sets of tables. The stopping powers were calculated within a modified Firsov model. An algorithm for determining the stopping power from v0 to v3 to 4 v sub o is discussed. GRA

N80-31167# Naval Research Lab., Washington, D. C. Plasma Radiation Group.
ELECTRON IONIZATION CROSS SECTIONS IN THE DISTORTED-WAVE APPROXIMATION Interim Report
M. Blaha and J. Davis 18 Jun. 1980 51 p refs
(RR0130143)
(AD-A087210; AD-E000478; NRL-MR-4245) Avail: NTIS HC A04/MF A01 CSCL 20/8

Eight different modifications (A1-A8) of the distorted wave approximation for the calculation of electron ionization cross sections are introduced and results are compared with other theoretical methods and experiment. Non-exchange approximations (A1-A4) are characterized by different orthogonal properties of wave functions and by different choices of asymptotic charges for the ejected electron. Results of these approximations are compared for H, He, He(+), Li(+), and Mg(+). The best approximation (A4) is then used for more complex atomic systems such as Li, C(+3), C(+), Ni(+), O(+), O, Ne(+), Na(+), and K(+). A4 generally agrees better with experiment than the Born or Coulomb-born approximation. Exchange approximations (A5-A8) are characterized by different choices of asymptotic charges in the exchange amplitude. These approximations have been tested on hydrogen and although a slight improvement over the non-exchange approximations has been obtained in the case of A5, the difference does not appear to be too significant. GRA

N80-31168# California Univ., Los Angeles. Dept. of Chemistry.
REACTIONS AND RELAXATION OF VIBRATIONALLY EXCITED HYDROGEN Final Report
Jerome V. V. Kasper 20 Jun. 1980 6 p
(Grant AF-AFOSR-3612-78; AF Proj. 2303)
(AD-A086976; AFOSR-80-0541TR) Avail: NTIS HC A02/MF A01 CSCL 07/4

One of the goals of this research was the measurement of H2(v equal 1) and H2(v equal 2) formed by the reaction of H with HI. The technique used is quantitative absorption spectroscopy on various absorption bands of H2 near 1100 angstroms in the vacuum ultraviolet. Preliminary calculations indicated that features due to HI in this region would be sufficiently weak under the desired operating conditions that quantitative spectroscopy of the transitions from the vibrationally excited H2 could be performed. This proved not to be the case. Pressures on the order of 10 to 100 millitorr of HI obscured the bands in this region. The signal/noise ratio of the original apparatus which employed sodium salicylate to down convert the vacuum ultraviolet photons to near uv-visible ones was inadequate to the task of unraveling the spectrum. Subsequent equipment improvements have reduced the source noise. The spectrometer and pressure gauge have been modified and interfaced to a digital computer. The analysis software determines the equivalent widths of the spectral features and converts these to pressures of H2 in specific (v, J) states. The flow system and reaction cell for the photolytic experiments proposed was constructed and awaits mating with the now operational laser. GRA

N80-31169# Air Force Geophysics Lab., Hanscom AFB, Mass. Optical Physics Div.
HIGH-TEMPERATURE, HIGH-RESOLUTION MEASUREMENTS OF CO2 IN THE REGION OF 2200 TO 2400 CM-1

Hajime Sakai (Massachusetts Univ., Amherst), Mark Esplin (Massachusetts Univ., Amherst), William Dalton (Massachusetts Univ., Amherst), and George A. Vanasse 27 Feb. 1980 21 p refs
(AF Proj. 2310)
(AD-A087234; AFGL-TR-80-0088; AFGL-ERP-698) Avail: NTIS HC A02/MF A01 CSCL 07/4

The CO2 vibrational rotational transition in the 4.3 micrometers region (2200 to 2400/cm) was observed at an elevated temperature of 600 K. The technique of Fourier spectroscopy was used to observe the spectrum with a resolution of 0.006/cm. The identified lines are expressed in terms of the molecular constants determined through the least-square-error fitting method. GRA

N80-31170# Syracuse Univ., N. Y. High Energy Theory Group.
RESEARCH PROGRAM IN ELEMENTARY PARTICLE THEORY Progress Report, period ending 30 Jun. 1980
1980 42 p refs
(Contracts EY-76-S-02-3533; DE-AS02-65ER-03533)
(COO-3533-161) Avail: NTIS HC A03/MF A01

Progress was made in the understanding of systems with unusual topological properties. A variational formulation of the equations that govern spinning particles in general relativity was accomplished. Perturbative as well as nonperturbative properties of quantum chromodynamics aspects were investigated. The question concerning gauge fixing in non-Abelian gauge theories was studied. Several new phenomenological aspects of unified electroweak interactions were explored with the object of finding experimental tests for models other than the currently accepted Salam-Weinberg theory. A unified electroweak model was investigated to account for the repeated fermionic generations and to incorporate CP violations and explain the CP violation as well as the Cabibbo-like angles in terms of the quark masses. A unified theory for all interactions was proposed. Finally, axially symmetric multi-instanton solutions were shown to be generated from a set of conformal mappings. DOE

N80-31171# Sandia Labs., Albuquerque, N. Mex.
LOW ENERGY ION BEAM SYSTEMS FOR SURFACE ANALYTICAL AND STRUCTURAL STUDIES
G. C. Nelson 1980 30 p refs Presented at Intern. Conf. on Low Energy Ion Beams, Bath, England, 14 Apr. 1980
(Contracts EY-76-C-04-0789; DE-AC04-76DP-00789)
(SAND-79-2392C; CONF-800466-2) Avail: NTIS HC A03/MF A01

The use of low energy ion beam systems for surface analytical and structural studies is addressed. Areas where analytical methods which utilize ion beams can provide a unique insight into materials problems are discussed. The design criteria of ion beam systems for performing materials studies are described and the systems now being used by a number of laboratories are reviewed. Finally, several specific problems are described where the solution was provided at least in part by information provided by low energy ion analysis techniques. DOE

N80-31172# Tennessee Univ., Knoxville. Dept. of Physics and Astronomy.
DIFFERENTIAL CHARGE TRANSFER TO THE CONTINUUM BY IONS IN ATOMIC HYDROGEN Progress Report and Renewal Proposal
Ivan Sellin and Robert S. Thoe 1980 26 p
(Contract DE-AS05-79ER-10512)
(DOE/ER-10512/T1) Avail: NTIS HC A03/MF A01

The projectile Z, velocity, angular, and charge state dependence of charge exchange to continuum states for H(+) C(6+), and O(8+) ions on atomic hydrogen are studied. Some technical details concerning work done in connection with the proposed experiment are given. An exploratory spectrum of continuum capture electrons from 234-MeV Ar(18+) on H2 is shown. DOE

N80-31173# Ohio State Univ., Columbus. Dept. of Physics.
ZERO-POINT ENERGY OF CONFINED FERMIONS
Kimball A. Milton 1980 23 p refs
(Contract DE-AC02-76ER-01545)
(DOE/ER-01545/274) Avail: NTIS HC A02/MF A01

A closed form for the reduced Green's function of massless fermions in the interior of a spherical bag is obtained. In terms of this Green's function, the corresponding zero point or Casimir energy is computed. It is proposed that a resulting quadratic divergence can be absorbed by renormalizing a suitable parameter in the bag model (that is, absorbed by a contact term). The residual Casimir stress is attractive, but smaller than the repulsive Casimir stress of gluons in the model. The result for the total zero point energy is in substantial disagreement with bag model phenomenological values. DOE

N80-31174# Montpellier Univ. (France). Dept. de Physique Mathematique.
THEORETICAL ASPECTS OF POSITRON ELECTRON ANNIHILATION AND HYPERON HYPERON COLLISIONS
F. M. Renard 1979 57 p refs Presented at Intern. School of Elementary Particle Phys., Kupari-Dubrovnik, Yugoslavia, Sep. 1979
(PM/79/15) Avail: NTIS HC A04/MF A01

Questions arising in quantum physics, specifically annihilation and particle collision processes, are discussed. General properties of the total cross section of the positron electron reaction which yields hadrons are given. The phenomenological parton model, quantum chromodynamic corrections, and nonperturbative effects are covered. Inclusive and exclusive final states of this annihilation reaction are brought up, leading to the parton jet model, variables for jet analysis, quantum chromodynamic jets, and gluon jets. Hyperon collisions are considered in terms of kinematical factors, leptonic processes, and hadronic production, resonances, and total cross section. These collisions are studied for hadronic production with high particle energies and involving quantum chromodynamic jets. Photon structure functions, deep inelastic processes, and exotic processes are also mentioned. Author (ESA)

N80-31175# Montpellier Univ. (France). Dept. de Physique Mathematique.
ON THE OPTIMALITY OF AXIOMATIC CONSTRAINTS FOR PION PION SCATTERING: THE CASE OF THE LOWER BOUNDS
G. Auberson and G. Mennessier 1979 13 p refs
(PM/79/16) Avail: NTIS HC A02/MF A01

A nine parameter family of pion-pion yields pion-pion amplitudes F(s,t) is constructed such that (1) all the analytic and unitary conditions used in the derivation of rigorous absolute bounds are satisfied and (2) F(s,t) can assume negative values in the unphysical region. Within this set the values of F(4/3,4/3) and of the scattering length a (00) = F(4,0) are minimized. Best results realized are F(4/3,4/3) = -1.69 and a (00) = -0.88, whereas the best present lower bounds are F(4/3,4/3) > -8.2 and a(00) > -1.65. Author (ESA)

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N80-31176 California Univ., Los Angeles.
INTERACTION BETWEEN PARTICLE BEAMS AND NONLINEAR STATES Ph.D. Thesis
Philip Lok-Wah Leung 1980 115 p
Avail: Univ. Microfilms Order No. 8016006

The effect of transit time damping on localized high frequency electric field was investigated. Computer simulation of the particle orbits inside a caviton is presented showing the energy exchange between the caviton and particles. Experiments illustrating various ways of enhancement and suppression of transit time damping are discussed. Results indicate that the rate of transit time damping depends critically on the ambient plasma particle distributions and the particle orbits. The formation of potential double layers in a current carrying plasma was studied. Measurements of particle distributions and the noise spectrum associating with a stationary double layer are presented. Moving double layers were observed when the drift velocity of electrons was approximately twice the thermal velocity. A model developed for double layer formation

can explain the physical mechanism for double layer formation and the existence of moving double layers. Dissert. Abstr.

N80-31177# Spire Corp., Bedford, Mass.
COLLECTIVE ION ACCELERATION AND ELECTRON BEAM PROPAGATION IN DIELECTRIC GUIDES Annual Report, 1 Feb. 1979 - 31 Jan. 1980
Ward Halverson and Anton C. Greenwald 1 Apr. 1980 35 p refs
(Contract F49620-79-C-0046; AF Proj. 2301)
(AD-A086493; AR-10067-01; AFOSR-80-0465TR) Avail: NTIS HC A03/MF A01 CSCL 20/7

Measurements of front velocity and transported electron beam current are reported for several configurations of dielectric guide. It appears that the ions which determine the speed of beam-front propagation come only from a short section of dielectric near the inlet of the guide. They are accelerated in the potential well of the virtual cathode formed when the space-charge-limited electron beam is injected. Plasma formed by electron bombardment of the downstream guide walls apparently does not influence the beam-front speed, although it is important in determining the efficiency of current transport. Measurements of collective ion acceleration have been deferred until the second year of the program. GRA

N80-31178# Naval Research Lab., Washington, D. C. Plasma Physics Div.
ABSOLUTE CALIBRATION OF A PROMPT GAMMA RAY DETECTOR FOR INTENSE BURSTS OF PROTONS
F. C. Young, F. Oliphant, S. J. Stephanakis, and A. R. Knudson 31 Mar. 1980 33 p refs Sponsored by DNA
(AD-A086726; AD-E000457; NRL-MR-4171) Avail: NTIS HC A03/MF A01 CSCL 18/4

A detector for determining the intensity and duration of kiloampere pulsed proton beams is described. Two different size detectors were calibrated absolutely using the continuous proton beam from a Van de Graaff accelerator. An absolute measurement of a kiloampere pulsed proton beam is described, and the measured current is in agreement with an independent determination of the total proton intensity by nuclear activation. GRA

N80-31179# Effects Technology, Inc., Santa Barbara, Calif.
TWCP ELECTRON BEAM TESTING PROGRAM: VOLUME 2: PRELIMINARY CHARACTERIZATION OF THE BLACKJACK 3 PULSED ELECTRON BEAM FOR MATERIAL RESPONSE STUDIES Final Report, Jul. 1977 - Dec. 1978
F. A. Bick, comp. 5 Apr. 1979 39 p refs 4 Vol.
(Contracts DNA001-76-C-0357; DNA001-78-C-0063)
(AD-A086306; AD-E300843; ETI-CR-79-610-Vol-2; DNA-5036F-2-Vol-2) Avail: NTIS HC A03/MF A01 CSCL 11/4

This volume describes the preliminary characterization of the Maxwell Laboratory Blackjack III pulsed electron beam facility as to energy spectrum, depth-dose profiles and fluence levels and uniformity. These tests were conducted preparatory to obtaining impulse and stress generation data on FM5822A carbon phenolic, and 91-LD phenolic resin. These tests demonstrated the capabilities of the Blackjack III facility for material response studies for peak electron energies of 0.7 to 1.0-MeV with fluence levels less than 200 cal/sq cm. GRA

N80-31180# Effects Technology, Inc., Santa Barbara, Calif.
TWCP ELECTRON BEAM TESTING PROGRAM: VOLUME 3: MATERIAL RESPONSE INSTRUMENTATION FOR THE BLACKJACK 3 ELECTRON BEAM FACILITY Final Report, Jul. 1977 - Dec. 1978
F. A. Bick, comp. 5 Apr. 1979 47 p refs 4 Vol.
(Contracts DNA001-76-C-0357; DNA001-78-C-0063)
(AD-A086307; AD-E300844; ETI-CR-79-610-Vol-3; DNA-5036F-3-Vol-3) Avail: NTIS HC A03/MF A01 CSCL 11/4

This volume describes the instrumentation developed to characterize the Blackjack III pulsed electron beam facility environment, and to obtain impulse and stress generation data on FM5822A carbon phenolic, and 91-LD phenolic resin. The primary diagnostical contribution was the development of an in situ fluence measurement technique that significantly reduced experimental uncertainties. Impulse data were obtained using a translating Ronchi ruling and fiber optic light guide. Stress data were obtained simultaneously with the impulse measurements using a laser interferometer. This technique increased the amount of data obtained, and also provides a direct correlation between the impulse and stress data. These gages were all designed to operate in the intense radiation environment associated with a pulsed electron beam machine, and also in the magnetic field (25 kG) used to guide the electron beam. GRA

N80-31181# Oak Ridge National Lab., Tenn.
SEARCH FOR MAGNETIC DIPOLE STRENGTH AND GIANT SPIN-FLIP RESONANCES IN HEAVY NUCLEI
D. J. Horen 1980 27 p refs Presented at Intern. Symp. on Highly Excited States in Nucl. Reactions, Osaka, 12 May 1980
(Contract W-7405-eng-26)
(CONF-800540-1) Avail: NTIS HC A03/MF A01

A description is given of the use of high-resolution (n,n) scattering and the (p,n) reaction as tools to investigate highly excited states, with emphasis on information pertaining to magnetic dipole strength and giant spin-flip resonances in heavy nuclei. It is shown how the ability to determine uniquely the spins and parities of resonances observed in neutron scattering was instrumental to an understanding of the distribution of M1 strength in Pb(207) and Pb(208). Some recent results of (p,n) studies with intermediate energy protons are discussed. Energy systematics of the giant Gamow-Teller (GT) resonance are presented. It is shown how the (p,n) reaction might be useful in locating M1 strength in heavy nuclei. DOE

N80-31182# California Univ., Berkeley. Lawrence Berkeley Lab.
WASTE ISOLATION SAFETY ASSESSMENT PROGRAM: TASK 4: COLLECTION AND GENERATION OF TRANSPORT DATA THEORETICAL AND EXPERIMENTAL EVALUATION OF WASTE TRANSPORT IN SELECTED ROCKS Annual Progress Report, 1 Oct. 1978 - 30 Sep. 1979
R. J. Silva, L. V. Benson, A. W. Yee, and G. A. Parks (Stanford Univ., Calif.) 30 Sep. 1979 109 p refs
(Contract W-7405-eng-48)
(LBL-9945) Avail: NTIS HC A06/MF A01

The sorption of cesium on the solid substrates Min-u-sil (quartz) and Belle Fourche clay (montmorillonite) was investigated. Cesium sorption isotherms were obtained for the two substrates at 26 C. Preliminary analysis of the sorption data indicate that while the clay data could be explained by simple mass action expressions, the quartz data could not. Theoretical efforts were aimed at developing and testing an electrolyte binding electrical double layer model to predict sorption isotherms. A computerized version of the model, MINEQL, which simultaneously considers surface and solution chemical equilibria, was brought to operational status. Input parameters required by MINEQL were determined and sorption isotherms for Cs on the Belle Fourche clay were calculated over the same range of parameters as the experimental measurements. Comparisons showed that the model was able to simulate the isotherms quite well except at the lowest pH values for the 0.002M and 0.01M NaCl solutions. DOE

N80-31183# Rockwell International Corp., Richland, Wash. Rockwell Hanford Operations.
STUDIES TO ASSESS THE FEASIBILITY OF STORING NUCLEAR WASTE IN COLUMBIA PLATEAU BASALTS
Raul A. Deju Jul. 1979 17 p refs Presented at the Intern. Symp. on Underground Disposal of Radioact. Wastes, Otaniemi, Finland, 2 Jul. 1979
(Contract EY-77-C-06-1030)
(RHO-BWI-SA-19; IAEA-SM-243/36; CONF-790711-5) Avail: NTIS HC A02/MF A01

The feasibility of utilizing Columbia Plateau Basalts as a site for terminal storage of commerical nuclear waste is addressed. Columbia Plateau basalts system integration, geology, hydrology, engineered barries studies, engineering testing, and the construction of a near surfaces test facility are briefly described. DOE

N80-31184# California Univ., Berkeley. Lawrence Berkeley Lab. Nuclear Science Div.
PHENOMENA AT VERY HIGH SPINS

F. S. Stephens Mar. 1980 14 p refs Presented at Conf. on Band Struct. and Nucl. Dyn., New Orleans, 27 Feb. - 1 Mar. 1980
(Contract W-7405-eng-48)
(LBL-10645; CONF-800213-11) Avail: NTIS HC A02/MF A01

A discussion of current ideas about the physics of very high spin states, some comments about noncollective behavior up to the highest spins where it is known, and a presentation of a method for studying collective behavior up to spins of 60 to 70 h are presented. The intention is that the overview presented in the first part will be sufficiently broad to indicate the relationship of the noncollective and collective behavior discussed in the other parts, and to provide some understanding of the compromise in behavior that seems to occur at the very highest spins. DOE

N80-31185# Sandia Labs., Albuquerque, N. Mex.
INTENSE PULSED ION BEAMS FOR FUSION APPLICATIONS
S. Humphries, Jr. Apr. 1980 220 p refs
(Contract EY-76-C-04-0789)
(SAND-80-0402) Avail: NTIS HC A10/MF A01

Ion injectors which utilize the introduction of electrons into vacuum acceleration gaps in conjunction with high voltage pulsed power technology to achieve high output current are discussed. Power levels from injectors exceeding 1000 MW/sq cm were obtained for pulse lengths on the order of 10 to the -7 sec. The physics and technology of intense ion beams and their applications in fusion research are considered. A number of potential uses in magnetic confinement systems are proposed. DOE

N80-31186# Texas A&M Univ., College Station. Dept. of Chemistry.
X-RAY EMISSION IN HEAVY-ION COLLISONS Progress Report, 1 Apr. - 31 Mar. 1980
R. L. Watson Apr. 1980 51 p refs
(Contract DE-AS05-78ER-06036)
(DOE/ER-06036/3) Avail: NTIS HC A04/MF A01

Results from several investigations of the X-ray emission in heavy-ion collisions are presented. Areas covered include; spectra of K alpha X-rays from 64 MeV sulfur ions traveling in solids; foil-excited K alpha X-ray transitions in few-electron sulfur ions; high resolution study of the target thickness dependence of X-ray emmision from 65 MeV sulfur ions; dynamic screening of highly stripped sulfur ions in solids; Mg K alpha X-ray satellites excited by ion bombardment, multiplet structure and dependence on projectile and chemical environment; angular distributions of beam and target K alpha X-ray; chemical effects on K X-ray satellites of fluorine compounds; and non linear least-squares peak-fitting program employing Voight functions. DOE

N80-31187# Rockwell International Corp., Golden, Colo. Energy Systems Group.
NATIONAL WASTE TERMINAL STORAGE PROGRAM: CONTAINMENT SYSTEM CONCEPTS FOR TRANSPORTING TYPE B QUANTITIES OF TRANSURANIC WASTE
Robert J. Rushton and Richard J. Merlini 14 Sep. 1979 94 p refs
(Contract EY-76-C-04-3533)
(RFP-2862) Avail: NTIS HC A05/MF A01

A series of shipping containment system preliminary concepts for Type B quantities of transuranic waste was formulated. The concepts were based on hypothetical accident protection requirements, potential waste forms, and selected hardware design/ considerations. The concepts consist of suggested waste system containment configurations and construction material suggestions. Analysis of the concepts, based on such features as fabrication ease and cost, utility, and payload efficiency, revealed that concepts utilizing processed waste forms and/or disposable waste packages to provide a major portion of the required accident protection are most favorable. DOE

N80-31188# California Univ., Livermore. Lawrence Livermore Lab.
ADVANCED THREE-DIMENSIONAL THERMAL MODELING OF A BASELINE SPENT FUEL REPOSITORY
Thomas J. Altenbach and William E. Lowry 29 Apr. 1980 55 p refs
(Contract W-7405-eng-48)
(UCID-18660) Avail: NTIS HC A04/MF A01

A three dimensional thermal analysis using finite difference techniques was performed to determine the near field response of a baseline spent fuel repository in a deep geologic salt medium. The base case in this thermal analysis considers one 10 year old pressurized water reactor (PWR) spent fuel assembly emplaced to yield a 36 kW/acre (8.9 W/sp m) loading. A unit cell model in an infinite array is used to simplify the problem and provide upper bound temperatures. Boundary conditions are imposed which allow simulations to 1000 years. Variations studied include a comparison of ventilated and unventilated storage room conditions, emplacement packages with and without air gaps surrounding the canister, and room cool down scenarios with ventilation following an unventilated state for retrieval purposes. It was found that at this low power level, ventilating the emplacement room has an immediate cooling influence on the canister and effectively maintains the emplacement room floor near the temperature of the ventilating air. DOE

N80-31189# Montpellier Univ. (France). Dept. de Physique Mathematique.
THE REACTION POSITRON ELECTRON YIELDS HYPERON + HADRONS AT HIGH ENERGY
M. Gourdin (Paris VI Univ.) and F. M. Renard Jul. 1979 18 p refs
(PM/79/18) Avail: NTIS HC A02/MF A01

Contributions to this reaction due to lepton radiation and central emission (expressed in terms of photon structure functions) are described in their most general form including weak neutral currents and polarization effects. The photon structure functions are calculated with the quark parton model. Applications to cross sections, photon spectra, asymmetries, and polarizations are given for the LEP energy range. Author (ESA)

74 OPTICS

Includes light phenomena.

N80-31190 Arizona Univ., Tucson.
SCATTERPLATE INTERFEROMETRY Ph.D. Thesis
Lawrence Francis Rubin 1980 142 p
Avail: Univ. Microfilms Order No. 8020324

A description of scatterplate interferometry from both a theoretical and experimental viewpoint is presented. Through the use of Fourier optics and stochastic processes techniques, a formalized theory of scatterplate interferometry is shown particularly in how the flip or inversion symmetry of the scatterplates itself affects the flip symmetry. Also described are the effects on the fringe quality produced by non-laser sources as well as aberrations in the interferometer optics. Experimental verification of these aspects is shown to be in good agreement with the theory. In addition, material is presented on scatterplate fabrication. Additional refinements including null testing with the scatterplate and an infrared scatterplate interferometer are also described. Dissert. Abstr.

N80-31191 Virginia Polytechnic Inst. and State Univ., Blacksburg.
MEASUREMENT OF SURFACE ROUGHNESS AND CORRELATION LENGTH USING DICHROMATIC SPECKLE Ph.D. Thesis
Mitrajyoti Deka 1980 74 p
Avail: Univ. Microfilms Order No. 8020178

A computer simulation study of the dichromatic speckle was conducted and the surface roughness and correlation length of sample surfaces were measured using a stylus instrument and similar measuroments with dichromatic speckle. The rms difference of the two speckle intensities was analyzed for spot sizes smaller than, comparable and larger than the correlation length of the surface. The rms roughness of the sample ground glasses was calculated from the data obtained from the stylus instrument. The correlation length was obtained from an online multichannel FFT processor connected to the stylus instrument. The correlation length was estimated from the correlation function. The rms

difference between the speckle intensities of two different wavelengths were measured for various spot sizes. For each intensity 64 K data samples was collected and processed in a PDP 11/40 computer. These data were used to calculate the second moment of the monochromatic speckle, the cross correlation of these and the rms difference. The roughness and the correlation length of the surface were estimated from these results. The results obtained from the dichromatic speckle are in good agreement with the values obtained from the stylus instrument. Dissert. Abstr.

N80-31182 Drexel Univ., Philadelphia, Pa.
A THEORETICAL STUDY OF TRANSIENT EFFECTS IN ABSORPTIVE OPTICAL BISTABILITY Ph.D. Thesis
James David Farina 1980 133 p
Avail: Univ. Microfilms Order No. 8019347

A bistable absorber in the good cavity limit and the Fokker-Planck equation that describes the time evolution of the quasi-probability distribution are considered. The existence of two distinct mechanisms of relaxation into steady state is established. The first consists of a local relaxation around the minimum (or minima) of a suitably defined potential. The second stage, which occurs over a much longer time scale, results from tunneling from one minimum to the other across the local maximum. Both mechanisms are considered. A linearization technique generalized for multistable systems is described and tested with numerical solutions of the Fokker-Planck equation. Tunneling is described, using a first passage technique, which is capable of modeling multistable systems. First passage times for optical bistability are calculated numerically and compared to previous tunneling estimates. Dissert. Abstr.

N80-31193*# Rensselaer Polytechnic Inst., Troy, N. Y. School of Engineering.
LASER OPTICAL APPRAISAL AND DESIGN OF A PRIME/ROVER INTERFACE
James A. Donaldson Jul. 1980 93 p refs
(Grant NsG-7369; Contract JPL-954880)
(NASA-CR-163508; RPI-TR-MP-68) Avail: NTIS HC A05/MF A01 CSCL 20F

An appraisal of whether to improve the existing multi-laser/multi detector system was undertaken. Two features of the elevation scanning mast which prevent the system from meeting desired specifications were studied. Then elevation scanning mast has 20 detectors, as opposed to the desired 40. This influences the system's overall resolution. The mirror shaft encoder's finite resolution prevents the laser from being aimed exactly as desired. This influences the system's overall accuracy. It was concluded that the existing system needs no modification at present. The design and construction of a data emulator which allowed testing data transactions with a PRIME computer is described, and theory of operation briefly discussed. A full blown PRIME/Rover Interface was designed and built. The capabilities of this Interface and its operating principles are discussed. R.K.G.

N80-31194# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ALIGNMENT OF LIQUID CRYSTALS BY SURFACE GRATINGS
David C. Shaver 31 Oct. 1979 71 p refs
(Contract F19628-80-C-0002; ARPA Order 3336)
(AD-A086816; ESD-TR-79-267; TR-538) Avail: NTIS HC A04/MF A01 CSCL 20/6

Square-wave grating structures with periodicities ranging from 3200 A to 12 micrometers were etched into fused quartz substrates, and the effect of such gratings on liquid crystal alignment was studied. Gratings with periodicities below 4 micrometers appear to be required to align typical room temperature nematic liquid crystals. At larger periodicities a pronounced defect texture forms. The defect texture is created during nucleation and growth of the nematic phase as it cools from the isotropic phase. The defect texture is stabilized by adsorption of an oriented molecular layer on the substrate surfaces. This adsorbed layer exerts an orienting torque on the bulk liquid crystal. Experiments were performed to demonstrate the existence of such an adsorbed layer. The tilt angle of the nematic director from the plane of quartz substrates was measured for liquid crystals used in the alignment experiments. M24 and the 'heptyl/butyl mixture' align with the director in the substrate plane. MBBA aligns with a tilt angle of about 23 deg on fused quartz, whether or not a grating structure is present. Surface gratings were also formed by patterning a 'monolayer' of DMOAP. Such patterned organic monolayers, which have no appreciable surface relief, are effective at aligning liquid crystals. This represents a new approach to liquid crystal alignment. High-quality alignment of the smectic A phase of M24 was induced by a 3200-A-period square-wave surface-relief grating. A novel twisted-nematic liquid crystal display which uses metal gratings for polarization of light as well as for liquid crystal alignment was fabricated. GRA

N80-31195# Honeywell Corporate Material Sciences Center, Bloomington, Minn.
OPTICAL INTERARRAY PROCESSING Final Report, 1 Oct. 1979 - 31 Mar. 1980
Mar. 1980 41 p refs
(Contract N00014-80-C-0216)
(AD-A086665) Avail: NTIS HC A03/MF A01 CSCL 20/6

This project had two major objectives. The first objective was to demonstrate nonreal time generation of ambiguity functions from one dimensional input transducers. The second objective was to design front end and rear end electronics capable of supporting real time operation of the optical processor. Both of these objectives were successfully achieved, and in addition, a new optical architecture was invented (LIPS), and its feasibility and superiority was experimentally demonstrated. The optical system demonstrating the proposed Passive Optical Tau-Shift concept (POTS) was designed with a large f number (=20) for aberration-free performance, and the system length became 12 meters. One dimensional Bragg cell-sized photographic transparencies were used to generate ambiguity functions. The results of processing both analytic V-FM signals and synthetic data from NOSC showed excellent agreement with theoretical predictions in terms of the correlation peak height and resolution. Another optical architecture based on an entirely new concept of a space variant Linear Phase Shifter (LIPS) was independently developed. It generates a tau-shift by a shear operation instead of the rotation used in pots. GRA

N80-31196# Electronics Research Lab., Adelaide (Australia).
THE SPECTRAL CHARACTERISTICS OF METAL FILM BEAM SPLITTERS
J. R. Venning Jan. 1980 56 p refs
(AD-A086419; ERL-0123-TR) Avail: NTIS HC A04/MF A01 CSCL 20/6

The spectral and polarisation characteristics of metallic beam splitters and mirrors made of single films of aluminum, silver, rhodium or nichrome on glass are described. Normal incidence transmission data of each thickness of metal film used in the beam splitter calculations is included for use when measuring or monitoring the deposition of the thin films. The presentation is mostly graphical and intended for the user and maker of simple metal beam splitters. GRA

N80-31197# ITT Electro-Optical Products Div., Roanoke, Va.
MANUFACTURING METHODS AND TECHNOLOGY PROGRAM FOR RUGGEDIZED TACTICAL FIBER OPTIC CABLE Quarterly Progress Report, 1 Jan. - 31 Mar. 1980
R. J. Hoss and R. Kopstein 26 Apr. 1980 71 p
(Contract DAAK80-79-C-0789)
(AD-A086874; ITT-80-17-048; CORADCOM-79-0789-3; QPR-3) Avail: NTIS HC A04/MF A01 CSCL 20/6

The scope of this quarter's effort, as reported herein, includes the following tasks and achievements: (1) Cable Process Optimization; (a) Complete polyurethane jacket evaluation samples (four types, four manufacturers), (b) Complete fungus testing, (c) Select optimized polyurethane type, (d) Begin optimized cable fabrication for third engineering sample, (e) Deliver second engineering sample and test report (lay length and polyurethane evaluation samples); (2) Use of Facilities; (a) Achieve 75% of production rate on the high speed strander, (b) Install new Kevlar serving line, start setting up, and make operational, (c) complete extruder set up and work toward 0.8 h/km rate, (d) Set up and make spooler operational, achieve 50% production rate, (e) Assemble test stations and characterize; and (3) Secondary Performance Milestones; (a) Achieve 0.5 dB/km induced attenuation from cabling operation. GRA

N80-31198# ITT Electro-Optical Products Div., Roanoke, Va.
MANUFACTURING METHODS AND TECHNOLOGY PROGRAM FOR RUGGEDIZED TACTICAL FIBER OPTICS CABLE Quarterly Progress Report, 1 Oct. - 31 Dec. 1979
R. J. Hoss and R. Kopstein 26 Jan. 1980 67 p
(Contract DAAK80-79-C-0789)
(AD-A086706; ITT-80-03-078; CORADCOM-79-0789-2; QPR-2) Avail: NTIS HC A04/MF A01 CSCL 20/6

The scope of this quarter's effort, as reported herein, includes the following tasks and achievements: (1) Cable Process Optimization-(a) Complete first engineering samples; test, select optimized fiber buffering, (b) Complete lay length evaluation samples; test, select optimized lay length, (c) Receive polyurethane materials (four types, four manufacturers); (2) Use of Facilities-(a) High speed strander, set up and operational; achieve 50% of production rate, (b) Extruder set up and operational, (c) Fiber optic measurement station design complete and partial fabrication. GRA

N80-31199# Purdue Univ., Lafayette, Ind.
CRITICALLY EVALUATED DATA ON OPTICAL AND TRANSPORT PROPERTIES OF SOLIDS REFRACTIVE INDEX AND ABSORPTION COEFFICIENT OF SELECTED OPTICAL MATERIALS Annual Report, 1 May 1979 - 30 Apr. 1980
H. H. Li 3 Jun. 1980 13 p refs
(Contract F44620-76-C-0105; AF Proj. 2308)
(AD-A086658; AFOSR-80-0539TR) Avail: NTIS HC A02/MF A01 CSCL 20/6

In this report, experimental material on the absorption coefficients of alkaline Earth halides was searched, compiled, and analyzed. It was found that the bulk of available data was concentrated to the absorption edges of the main transparent region for the four materials calcium fluoride, strontium fluoride, barium fluoride, and magnesium fluoride. An equation was formulated to best describe the absorption data in the infrared multiphonon region as a function of both frequency and temperature. It was noted that the same type of equation is equally valid for both alkaline Earth halides and alkali halides. Although the intrinsic abosrption was predicted by the proposed equation, discrepancies might occur in the region where absorption is extremely low and where extrinsic absorptions due to impurities and surface contamination dominate the intrinsic absorption by factors ranging from fractions to multiples of ten. Experience has shown that extrinsic contributions can be reduced through improved crystal growing and surface polishing techniques. The work on the absorption coefficient of silicon and germanium was in progress. It was found that the absorption coefficient is sensitive to the amount and kind of impurities usually being introduced as desirable dopants. Numerous experimental material was made available. Currently the work remained in the stage of data extraction and compilation. GRA

N80-31200# California Univ., Livermore. Lawrence Livermore Lab.
COMPREHENSIVE DESCRIPTION OF FIELDS IN OPTICAL FIBERS BY MEANS OF THE PROPAGATING BEAM METHOD
M. D. Feit and J. A. Fleck, Jr. Apr. 1980 27 p refs Presented at Conf. on Phys. of Fiber Optics, Chicago, 28 Apr. 1980; sponsored by Am. Ceramic Soc.
(Contract W-7405-eng-48)
(UCRL-84219; CONF-800430-1) Avail: NTIS HC A03/MF A01

The propagating beam method is shown to provide a configuration space description of the field in an optical fiber and generate all of the information necessary for a complete description of the field in terms of modes. Illustrations are given of the method's capabilities for generating mode eigenfunctions, eigenvalues, and group delays for several index profiles of practical interest. DOE

N80-31201# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik.
COMPUTER CONTROLLED MEASUREMENT OF SHAPES AND THEIR VARIATIONS BY MEANS OF ACTIVE TARGETS AND AN OPTOELECTRONIC CONVERTER [RECHNERGESTEUERTE FORM- UND VERFORMUNGSMESSUNG MITTELS AKTIVER ZIELPUNKTE UND OPTOELECTRONISCHER WANDLER]
J. H. Argyris, W. Aicher, K. Eberle, and M. Kirschstein Sep. 1979 24 p refs In GERMAN
(Contract DFG-AR-44/27/41)
(ISD-245) Avail: NTIS HC A02/MF A01

The suitability of a system for the measurement of displacements and deformations by means of a computer controlled optoelectronic system was studied. Efforts to increase precision and resolution by means of analytical corrections are described. Author (ESA)

N80-31202# Thomson-CSF, Orsay (France). Lab. Central de Recherches.
NONLINEAR OPTICS IN GUIDED STRUCTURES. APPLICATION TO FREQUENCY DOUBLING Final Report [OPTIQUE NON LINEARE EN STRUCTURES GUIDEES. APPLICATION AU DOUBLAGE DE FREQUENCE]
M. Papuchon and M. Digonnet 12 Jan. 1978 33 p refs In FRENCH
(Contract DGRST-77-7-0086)
(LCR-78-05/R/G5) Avail: NTIS HC A03/MF A01

The possibility of the formation of a second harmonic in optical waveguides was studied particularly in those made through metallic diffusion in crystals such as LiNbO3 or LiTaO3. Waveguides made by the diffusion of titanium in LiNbO3 were designed and tested. The results obtained from the testing of waveguides in LiTaO3 through local metallic diffusion are presented. Author (ESA)

N80-31203# Thomson-CSF, Meudon-la-Foret (France). Lab. Central de Recherches.
USE OF INTEGRATED OPTICS FOR ANALOG DATA SIGNAL CONDITIONING ABOARD SPACECRAFT Final Report
C. Puech, M. Papuchon, and J. C. Anne Sep. 1979 121 p refs
(Contract ESTEC-3746/78-NL-PP(SC))
(LCR-79-108/R/G5; ESA-CR(P)-1300) Avail: NTIS HC A06/MF A01

A predesign elaboration is presented of an optical conditioning unit for the data delivered by a multispectral scanner using integrated optics and fiber optics technology. A laboratory model of an integrated optical amplitude modulator was built. The system was selected as a model for a representative optical waveguide system for use on board spacecraft. It consists of an optical data conditioning unit that would be used in conjunction with a multispectral camera to perform sensor signal pre-processing operations, such as: remotely controlled amplitude and dc level adjustments, data multiplexing and analog-to-digital conversion. The implementation described uses hybrid optical waveguide technology. It permits the definition of key optical elements, such as the digitally driven amplitude modulator. Author (ESA)

N80-31204# National Bureau of Standards, Boulder, Colo. Electromagnetic Technology Div.
MEASUREMENT OF OPTICAL FIBER BANDWIDTH IN THE TIME DOMAIN
Douglas L. Franzen and G. W. Day Feb. 1980 72 p refs Sponsored in part by DOD
(PB80-177421; NBS-TN-1019) Avail: NTIS HC A04/MF A01 CSCL 20F

A system for determining optical fiber bandwidth from time domain information is described. A measurement gives the optical fiber transfer function (or frequency response) relating the output waveform to the input. An analysis is given of the variables affecting the measurement. This includes a discussion of such input related topics as launching conditions, mode scramblers, and laser diode sources; output related topics include a discussion of optical detectors. Laser diodes are evaluated with respect to short pulse performance, near field emission, material dispersion limits, and other spectral behavior like chirping; detectors are evaluated with respect to time response, linearity, and uniformity. A number of bandwidth related topics are briefly presented and typical experimental results given. GRA

N80-30331*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SIGNAL TO NOISE RATIO CALCULATION FOR FIBER OPTICS LINKS

K. Y. Lau *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 41-48 refs (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 20F

N80-30337*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SPATIAL ACQUISITION OF OPTICAL SOURCES IN THE PRESENCE OF INTENSE INTERFERENCE
V. A. Vilnrotter *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 91-96 refs (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 20F

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N80-31205 Lehigh Univ., Bethlehem, Pa.
A SEARCH FOR THE PERSISTENT VELOCITY AUTOCORRELATION IN HYDROGEN BY DENSE PLASMA DECAY Ph.D. Thesis
Hyo Sang Lee 1980 169 p
Avail: Univ. Microfilms Order No. 8019719

A pulsed plasma was produced in very high density neutral hydrogen gas by a 20 ns, 60 KV Blumlein discharge and six simultaneous time resolved diagnostic measurements were carried out during a 3 micron period in order to describe the full plasma evolution. The whole experiment is repeated for various densities between one twelfth and one sixth of the close packing density. A numerical simulation code was developed to independently reproduce all measurable details of the full evolution of the laboratory plasma. The simulation was successful in predicting correctly all measured features of the plasma in the afterglow regime, thus establishing the simulation as a reliable basis for testing the reality of the Alder-Wainwright effect. In regard to the persistent velocity autocorrelation, the question remains unresolved because the experimental uncertainty is slightly greater than the difference between the two results of the simulation one with and the other without the Alder-Wainwright effect in the diffusion coefficient, over the entire range of the gas density covered in the experiment. Dissert. Abstr.

N80-31206 California Inst. of Tech., Pasadena.
PARTICLE CONFINEMENT AND MAGNETIC FLUCTUATIONS IN TOKAMAK DISCHARGES WITH GAS PUFFING Ph.D. Thesis
Bruce Stephen Levine 1980 193 p
Avail: Univ. Microfilms Order No. 8019905

Particle confinement and magnetic fluctuations associated with short (< 1 msec) gas pulses into a Tokamak discharge are investigated experimentally. The fluctuations are measured with movable pairs of magnetic probes, each containing a poloidal and radial coil and inserted into the outer regions of the plasma. When neutral gas is added and the current channel contracts, the fluctuation spectra are dominated by an m = 2 mode that grows with the classical tearing-mode rate. When the gas feed is terminated, much broader spectra of modes with m up to 15 are observed. The m = 2 mode dominates the poloidal spectra, while the radial spectra have numerous modes of appreciable amplitude. Time-delay measurements suggest that many of the higher order (m > 3) modes originate in deformation of the m = 2 and m = 3 magnetic islands. A strong m = 7 is found to be localized near the limiter in q(a) = 3.8 discharges, hence this mode is identified as an m = 7, n = 2. It is found that the m = 2 mode becomes destabilized for discharges for which the peak puff density approaches the upper limit given by the Murakami scaling relation.
Dissert. Abstr.

N80-31207# Naval Research Lab., Washington, D. C.
THE NONLINEAR DYNAMICS OF MHD UNSTABLE PLASMAS Interim Report
Wallace M. Manheimer 12 May 1980 69 p
(AD-A086729; AD-E000453; NRL-MR-4175) Avail: NTIS HC A04/MF A01 CSCL 20/9

Topics covered include: (1) quasilinear theory and Rutherford's nonlinear theory of tearing modes; (2) island overlap and the onset of stochasticity; (3) the Taylor-Woltjer theory of spontaneous field reversal and current limitation; and (4) Kadomtsev's theory of internal disruptions and an introduction to numerical simulations. A.R.H.

N80-31208# Naval Research Lab., Washington, D. C.
HIGH ORDER ZIP DIFFERENCING OF CONVECTIVE TERMS Interim Report
Steven T. Zalesak 8 May 1980 39 p refs Sponsored by DNA
(AD-A086725; AD-E000458; NRL-MR-4218) Avail: NTIS HC A03/MF A01 CSCL 20/9

The ZIP flux form for differencing the term (wv) sub x, where w is a convected quantity and v is a convective velocity, is observed to be equivalent to differencing the alternative expression wv sub x - w sub x v using centered second order finite differences. Based on this observation, the extension of the ZIP flux concept to arbitrarily high order accuracy is given. Computational examples show the advantage both of the ZIP flux concept itself and of its higher order forms within the context of flux-corrected transport (FCT) algorithms. GRA

N80-31209# Naval Research Lab., Washington, D. C.
PROPERTIES OF ABLATIVELY ACCELERATED TARGETS
B. H. Ripin, S. E. Bodner, S. H. Gold, H. R. Griem, J. Grun, M. J. Herbst, R. H. Lehmberg, E. A. McLean, J. M. McMahon, and S. P. Obenschain 16 May 1980 34 p refs Presented at CLEOS/ICF '80 Topical Meeting on Inertial Confinement Fusion, San Diego, Calif., 27 Feb. 1980 Sponsored by DOE (RR0110941)
(AD-A086727; AD-E000456; NRL-MR-4212) Avail: NTIS HC A03/MF A01 CSCL 20/9

Targets are ablatively accelerated to high velocity (10 to the 7th power cm/s) with good hydrodynamic efficiency (about 20%) using low-irradiance (10 to the 13th power - 10 to the 14th power) long (3 - 4 ns) Nd-laser pulses. Detailed properties of the interaction and acceleration as well as comments upon the suitability of this approach to the laser fusion application are presented. Results of unique 'double-target' experiments are also included. GRA

N80-31210# California Univ., Los Angeles. School of Engineering and Applied Science.
STUDIES OF NONLINEAR PHENOMENA IN PLASMAS Final Report, 1 Jan. 1979 - 31 Mar. 1980
P. K. C. Wang Mar. 1980 150 p refs
(AF Proj. 2301)
(AD-A086456; UCLA-ENG-8012; AFOSR-80-0502TR) Avail: NTIS HC A07/MF A01 CSCL 20/9

This report summarizes the result of a study on nonlinear phenomena in plasmas with main emphasis on developing deterministic theories for plasma turbulence based on the Ruelle-Takens theory of strange attractors, and on the interaction of solitons. The main results include the demonstration of the occurrence of turbulence-like solutions in a simplified Zakharov model for Langmuir turbulence and a number of nonlinear three wave interactions. he stability of mode converted lower hybrid solitons is also studied. GRA

N80-31211# Naval Research Lab., Washington, D. C. Plasma Physics Div.
MHD PLASMA CHANNEL RESPONSE TO PROPAGATING ION BEAMS Interim Report
D. G. Colombant, D. Mosher, and Shyke A. Goldstein 24 Jun. 1980 14 p refs
(AD-A087214; AD-E000473; NRL-MR-4252) Avail: NTIS HC A02/MF A01 CSCL 20/9

Hydrodynamic response of plasma channels induced by intense propagating ion beams is examined using both analytical estimates and a one dimensional radial numerical model. It is found that mega-ampere, 3-5 MeV proton beams can be propagated in deuterium background over several meters. GRA

N80-31212# Naval Research Lab., Washington, D. C.
GAS CHANNEL FORMATION STUDIES INCLUDING REAL-AIR THERMODYNAMIC PROPERTIES
Selig Kainer and Martin Lampe 26 Jun. 1980 31 p refs
(ARPA Order 3718)
(AD-A086999; AD-E000490; NRL-MR-4247) Avail: NTIS HC A03/MF A01 CSCL 20/13

Real-air thermodynamic properties are included in studies of reduced density channel formation by expansion of a heated cylinder of air. A model for density profile at late times, previously given for a polytropic ideal gas, is extended to the present case. It is shown that a relation between pressure P, density rho, and specific energy epsilon, of the form properties. The variation of f with epsilon, i.e., of specific heat with temperature, can strongly modify the initial pressure profile associated with a given energy density profile. The effects of real-gas thermodynamics during the hydrodynamic expansion, on the other hand, are rather weak. GRA

N80-31213# Oak Ridge National Lab., Tenn.
LARGE ASPECT RATIO TOKAMAK STUDY
R. L. Reid, J. A. Holmes, W. A. Houlberg, Y. K. M. Peng, D. J. Strickler, T. G. Brown, C. Sardella, and G. W. Wiseman 1979 6 p refs Presented at 8th Symp. on Eng. Probl. of Fusion Res., San Francisco, 13 Nov. 1979 Prepared in cooperation with Grumman Aerospace Corp., Bethpage, N.Y.
(Contract W-7405-eng-26)
(CONF-791102-156) Avail: NTIS HC A02/MF A01

The potential for producing a viable long burn Tokamak reactor through enhanced volt-second capability of the ohmic heating transformer by employing high aspect ratio designs was investigated. The plasma physics, engineering, and economic implications of high aspect ratio Tokamaks were accessed in the context of extended burn operation. Plasma startup and burn parameters were addressed using a one dimensional transport code. The pulsed electrical power requirements for the poloidal field system, which have a major impact on reactor economics, were minimized by optimizing the field in the ohmic heating coil and the wave shape of the ohmic heating discharge. A high aspect ratio reference reactor was chosen and configured. DOE

N80-31214# Department of Energy, Washington, D. C.
ASSESSMENT OF THE US MIRROR FUSION PROGRAM. REPORT OF THE 1980 MIRROR SENIOR REVIEW PANEL
Apr. 1980 36 p
(DOE/ER-0057) Avail: NTIS HC A03/MF A01

Progress in the magnetic confinement of high temperature plasmas for the release of fusion energy is reported. Emphasis is placed on the development of the tandem mirror concept, and its incorporation into the single cell mirror reactor. L.F.M.

N80-31215# California Univ., Livermore. Lawrence Livermore Lab.
NONLINEAR EVOLUTION OF RESISTIVE INTERCHANGE MODES IN REVERSED FIELD PINCHES
D. D. Schnack and J. Killeen Apr. 1980 6 p refs Presented at RFP Workshop, Los Alamos, New Mex., 28 Apr. - 2 May 1980 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-84301) Avail: NTIS HC A02/MF A01

The results are presented of the application of a two dimensional resistive MHD computer code to the nonlinear evolution of resistive interchange modes in tearing-mode-stable reversed field pinch equilibria. One finds the m = 1 mode is insignificant when the singular surface is outside the field reversal point, and is more active nonlinearly but still fairly localized when the singular surface lies in the inner regions of the plasma. The m = 0 mode, which is not present in Tokamaks, is found to lead to highly distorted flux surfaces and interchange vortices of large radial extent when beta is near the Suydam marginal point. However, if the initial beta is sufficiently small, this mode remains localized allowing significant Ohmic heating of the pinch to occur. DOE

N80-31216# California Univ., Livermore. Lawrence Livermore Lab.
TECHNIQUES OF PLASMA PRODUCTION AND HEAT. 32: PLAN FOR THE PLASMA MICROWAVE-HEATING SYSTEM AT THE T-10M FACILITY
V. A. Flyagin, V. V. Alikaev, S. N. Vlasov, A. G. Luchinin, G. S. Nusinovich, V. G. Usov, and V. I. Khizhnyak Jan. 1980 10 p refs Transl. into ENGLISH from Conf. on Eng. Probl. of Thermonucl. Reactors (USSR) p 3-9 Conf. held in Leningrad, 28 Jun. 1977
(UCRL-Trans-11563; CONF-770611B) Avail: NTIS HC A02/MF A01

A plasma heating technique is proposed which uses an ordinary wave whose electric field during transverse propagation is parallel to the longitudinal magnetostatic field of the chamber. Such a wave can be introduced into the Tokamak from the outside of the torus, where there are large ports in the vacuum chamber of the apparatus. The width of the plasma layer in which microwave energy is absorbed decreases as the angle between the wave vector K vector and the direction of the chamber longitudinal magnetic field H vector approaches 90 deg. To test this assertion experimentally in the T-10M facility, it is proposed to provide adjustment of the angle of injection of microwave radiation into the Tokamak. DOE

N80-31217# Mathematical Sciences Northwest, Inc., Bellevue, Wash.
PLASMA ROTATION IN REVERSED-FIELD THETA PINCHES
L. C. Steinhauer Feb. 1980 54 p refs
(Contract DE-AC06-76ET-53027)
(MSNW-80-1144-1) Avail: NTIS HC A04/MF A01

Field reversed plasmas were observed to spin up and develop a destructive rotating m = 2 instability. While the instability threshold has been reasonably well characterized, the cause of the rotation remains obscure. Of the several mechanisms proposed, one of the most likely is the following: end shorting on open field lines spins up that portion of the plasma; viscous drag then spins up the plasma on closed field lines. Theoretical models are developed to describe these processes. The predicted behavior falls into three regimes. For low aspect ratio (equal to or less than 2.5) the plasma is highly viscous, rotates as a rigid body and spins up to instability in a few Alfven transit times. At intermediate aspect ratio (2.5 to 4) the plasma is weakly viscous; it reaches instability in the viscous transfer time which lengthens very rapidly for higher aspect ratio. At high aspect ratio (equal to or greater than 4) spin up is slower than the resistive decay of the plasma, and instability should not arise. DOE

N80-31218# Naval Research Lab., Washington, D. C. Plasma Physics Div.
HARD X-RAY SPECTRUM FROM A ONE-FLUID LASER PLASMA MODE Interim Report
D. G. Colombant and W. M. Manheimer 27 May 1980 15 p refs
(Contract ES-77-A-01-6021)
(NRL-MR-4241) Avail: NTIS HC A02/MF A01

Comparisons between hard X-ray experimental spectra and those obtained from a one dimensional, one temperature fluid laser-produced plasma model show good agreement over several orders of magnitude in X-ray intensity and for Nd-laser irradiances varying between 1 and 8 x 10 to the 15th power w/sq cm. The key to this agreement is the careful modeling of electron energy flux limitation by return current driven ion acoustic turbulence. DOE

N80-31219# Princeton Univ., N. J. Plasma Physics Lab.
VORTEX FORMATION DURING rf HEATING OF PLASMA
R. W. Motley May 1980 50 p refs
(Contract DE-AC02-76CH-03073)
(PPPL-1658) Avail: NTIS HC A03/MF A01

Experiments on a test plasma show that the linear theory of waveguide coupling to slow plasma waves begins to break down if the RF power flux exceeds 30 W/ sq cm. Probe measurements reveal that within 30 microseconds an undulation appears in the surface plasma near the mouth of the twin waveguide. This surface readjustment is part of a vortex, or off-center convective cell, driven by asymmetric RF heating of the plasma column. DOE

N80-31220# California Univ., Livermore. Lawrence Livermore Lab.
ADIABATIC COMPRESSION OF FIELD-REVERSED PLASMA
J. W. Shearer 28 Apr. 1980 20 p refs
(Contract W-7405-eng-48)
(UCID-18614) Avail: NTIS HC A02/MF A01

Field-reversed plasma compression occurs in a number of different contexts. Theta pinches are compressed by a time-increasing magnetic field, produced either by a large mirror field supply or by a moving conductor (liner). A moving field-reversed plasma that encounters an increasing magnetic mirror field also experiences compression due to the increase in the local field as seen by the plasma. This interaction occurs at the entrance to the moving ring reactor and in the BETA-II plasma ring injection experiment. The adiabatic compression of the moving ring is considered by means of some dimensional scaling rules. DOE

N80-31221# Princeton Univ., N. J. Plasma Physics Lab.
REVIEW OF THE WALL PROBLEM AND CONDITIONING TECHNIQUES FOR TOKAMAKS
H. F. Dylla May 1980 39 p refs
(Contract DE-AC02-76CH-03073)
(PPPL-1666) Avail: NTIS HC A03/MF A01

A review is given of the present understanding of the physical mechanisms, the resulting surface effects, and benefits to plasma performance of the various conditioning procedures. Particular attention is given to the application of hydrogen glow discharge cleaning and the use of titanium gettering as conditioning procedures. DOE

N80-31222# Westinghouse Electric Corp., Pittsburgh, Pa. Advanced Energy Systems Div.
MHD ELECTRODE DEVELOPMENT Quarterly Report, Oct. - 30 Dec. 1979
John W. Sadler, Laurance H. Cadoff, Jeff Bein, W. Dean Coe, Jr., James A. Dilmore (Westinghouse Research and Development Center), Edsel W. Fratti, Dave Jacobs, Edgar L. Kochka, Jack A. Kuszyk, S. K. Lau et al Feb. 1980 119 p refs
(Contract DE-AC01-79ET-15529)
(FE-15529-5) Avail: NTIS HC A06/MF A01

Results of bonding studies in support of an evaluation of platinum capped anodes and iron cathodes are presented. In addition, an attachment technique has been developed for bonding the indium-doped hafnia current leadout material to a compliant nickel mesh and results are reported. Laboratory electrochemical corrosion tests indicate that major reductions in polarization, electrical resistivity and ionic transference number of the slag can be achieved with moderate additions of cobalt which will produce a significant reduction in the electrochemical stress. Status of design, procurement and modification activities in support of the installation of a conventional three tesla magnet is presented. DOE

N80-31223# Fom-Instituut voor Plasmafysica, Jutphaas (Netherlands).
COLLISIONAL PLASMA TRANSPORT: TWO DIMENSIONAL SCALAR FORMULATION OF THE INITIAL BOUNDARY VALUE PROBLEM AND QUASI ONE DIMENSIONAL MODELS Thesis - Utrecht Univ.
J. W. Mugge Oct. 1979 242 p refs Sponsored by EURATOM and Nederlandse Organisatie voor Zuiver-Wetenschappelijk Onderzoek
(Rept-79-120) Avail: NTIS HC A11/MF A01

The collisional plasma transport problem was formulated as an initial boundary value problem for general characteristic boundary conditions. Starting from the full set of hydrodynamic and electrodynamic equations, an expansion in the electron-ion mass ratio together with a multiple timescale method yield simplified equations on each timescale. Through the introduction of potentials a two dimensional scalar formulation in terms of quasilinear integrodifferential equations of second order for a domain consisting of plasma and vacuum subdomains was obtained. For both one dimensional and quasi-one dimensional geometries the initial boundary value problem was reduced to a free boundary problem consisting of a system of four strongly coupled quasilinear second order integrodifferential equations of the parabolic type with plasma boundary conditions of a generalized third type. The local plasma velocity as well as the spatial second order differential structure (diffusion matrix) were explicity derived for both the plane and circular slab (belt) geometry. Author (ESA)

N80-31224# Fom-Instituut voor Plasmafysica, Jutphaas (Netherlands).
IDEAL MAGNETOHYDRODYNAMIC EQUILIBRIUM OF A WEAKLY TOROIDAL PLASMA WITH ELONGATED CROSS SECTION. PART 1: ELLIPTIC CROSS SECTION
W. Schuurman and E. J. M. VanHeesch Oct. 1979 21 p refs Sponsored by EURATOM and Nederlandse Organisatie voor Zuiver-Wetenschappelijk Onderzoek
(Rept-79-121-Pt-1) Avail: NTIS HC A02/MF A01

Analytic solutions are constructed of the ideal magnetohydrodynamic equations describing the equilibrium of a toroidal plasma with an elliptic cross section and surrounded by vacuum. The method used is a series expansion in the inverse aspect ratio. The toroidal effects considered include the appearance of a toroidal surface current and a shift of the stagnation points in the vacuum towards the major axis of the torus. The demand of negligible second order effects excludes the appearance of a second magnetic axis or any other equilibrium limit on beta. With a metal wall placed arbitrarily on one of the flux surfaces in the vacuum, a formula is derived for the toroidal shift of the plasma column as a function of the compression ratio, the poloidal beta and the ellipticity. Numerical examples show that for high compression ratios the toroidal shift decreases considerably if the ellipticity is increased. At low values of the compression ratio, however, there exists a critical ellipticity where the toroidal displacement has a minimum. Author (ESA)

N80-31225# Messerschmidt-Boelkow G.m.b.H., Ottobrunn (West Germany).
EFFECTIVE COLLISION FREQUENCY AND ELECTRON TEMPERATURE IN A WEAKLY IONIZED ARGON PLASMA
C.-P. Schneider 18 Oct. 1979 23 p refs
(MBB-UA-498-79OE) Avail: NTIS HC A02/MF A01

The effective collision frequency, nu, of a low density, shock heated argon plasma under the influence of a weak electric field which oscillates harmonically with angular frequency sigma was calculated. It is shown that for the high frequency case sigma > nu bar where nu bar is the collision frequency in a Maxwellian gas plasma, one has nu asymptotic to 2 nu bar provided that the imaginary part of the argon plasma conductivity is negligibly small in comparison to the real part. The influence of the theoretical model used to calculate nu on the values of the electron temperature derived from measurements is next compared to results obtained by data reduction in which the hard sphere model for particle encounters was utilized. It is found that a single power law assumption for argon electron cross sections over the temperature range 3000 to 10,000 K leads to appreciable errors. Therefore, a numerically integrated average momentum corss section is considered to yield most accurate results when applied in connection with the hard sphere model. Author (ESA)

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also 33 *Electronics and Electrical Engineering* and 36 *Lasers and Masers*.

N80-31226 California Inst. of Tech., Pasadena.
INFLUENCE OF JOSEPHSON EFFECT ON PROXIMITY COUPLED SUPERCONDUCTORS Ph.D. Thesis
Warren Yiu-Cho Lai 1980 264 p
Avail: Univ. Microfilms Order No. 8020423

Experimental investigations to examine the influence of Josephson effect on proximity coupled superconductors are reported. The results are interpreted with a proposed physical model that incorporates spatial gradients in both the phase and the amplitude of the proximity induced energy gap. Calculations based on this model successfully describe and explain most of the experimental observations. This model also indicates the

evolution of weak coupling (Josephson effects with two superconductors) to strong coupling (phase slip in one dimensional superconductor) in superconductivity. A major influence of Josephson effect on proximity coupled superconductors is the distinction between the phase in the current-phase relationship and phase in the voltage-phase relationship in both the stationary and nonstationary situations. This distinction leads to the possibility of multiple states of proximity induced superconductivity. The transition between these states is identified as a phase slip process involving phase change of less than 2 pi. This phase slip in the nonstationary regime results in a supercurrent with an a.c. component and a d.c. component. Dissert. Abstr.

N80-31227 Oregon Univ., Eugene.
QUANTUM LIMIT MAGNETOCONDUCTIVITY IN THE DILUTE IMPURITY REGIME Ph.D. Thesis
Shamsi-Deen Babatunde Elegba 1980 115 p
Avail: Univ. Microfilms Order No. 8018850

A system containing a low concentration of impurities with short-ranged potentials in the presence of a very strong magnetic field is investigated. Here, fairly realistic potential models such as the Thomas-Fermi potential are considered. These potential models are approximated in a systematic fashion to obtain a potential model for which there is an exact expression for the single site t-matrix. The single site t-matrix is then inserted into a general expression for the static magnetoconductivity tensor. The potential models used are all non-local and their non-locality alters the velocity operator which in turn changes the transport properties of the system. A generalization of the Nozieres result is obtained for the Hall conductivity sigma xy plus a correction term which is very important in the case of strong potential scattering. Thus the Hall conductivity obtained in this work can differ greatly from the usual semiclassical expression for strong scattering. The result obtained for sigma xx in the present work is, however, similar to Noziers' except that the inconsistency in the potential model leads to a different numerical result.
Dissert. Abstr.

N80-31228 Pennsylvania Univ., Philadelphia.
INELASTIC ELECTRON TUNNELING SPECTROSCOPY INTENSITIES AS A FUNCTION OF SURFACE COVERAGE: EXPERIMENTAL DETERMINATION, PHYSICAL MODEL, AND APPLICATION Ph.D. Thesis
Andrew Arnold Cederberg 1980 152 p
Avail: Univ. Microfilms Order No. 8018531

Inelastic Electron Tunneling (IET) spectra were taken using standard experimental techniques and a liquid doping procedure. The surface coverage determined independently by selecting the dopant solution concentration. The connection between dopant solution concentration and surface coverage is explained by using a statistical mechanical model to derive adsorption isotherms relevant to IETS doping. Using the adsorption isothermal analysis, the binding energy of the benzoate ion on alumina is extracted from published experimental data. Intensities for nine modes of benzoic acid are examined at coverages of 9 percent to 83 percent of full monolayer coverage and one mode of acetic acid is studied at coverages from 25 percent to 95 percent of monolayer coverage. It is found that IETS intensity, defined in the usual way as the normalized change in conductance, is a nonlinear function of surface coverage. A physical model is presented which attributes this behavior to a difference in elastic tunneling conductances for electrons traversing empty or filled regions of the dopant layer in a partially doped IET junction. The intensity results are applied to the study of the reaction which binds the acid to the oxide surface during IETS doping. Dissert. Abstr.

N80-31229 Pennsylvania Univ., Philadelphia.
THEORETICAL AND EXPERIMENTAL INVESTIGATION OF BONDING OF SIMPLE LIGANDS TO METAL COMPLEXES AS REFLECTED IN THEIR PHOTOELECTRON SPECTRA Ph.D. Thesis
Guillermo Manuel Loubriel 1980 212 p
Avail: Univ. Microfilms Order No. 8018575

The interaction between small molecules and transition metal atoms is investigated. Nitric oxide adsorbed on clean metal surfaces and transition metal complexes like Cr(NO)4, Cr(CO)6 and Ni(CO)4 were studied. The approach used was to learn as much as possible about the electronic structure and bonding in carbonyls and nitrosyls where the atomic positions were known and use this knowledge to help determine the bonding geometry of NO adsorbed on Ni(100). In addition to the analysis of photoemission, theoretical calculations of electronic structure via the self-consistent field X alpha multiple scattering technique were performed. The bonding of NO to transition metal atoms occurs mainly through the interaction of the levels of the metal atom and the 2 pi level of NO. In Cr(NO)4 this bonding is reflected in a charge transfer of about half an electron into the 2 pi level of each one of the NO molecules. The results of first principles calculations of shakeup energies and shakeup intensities for the photo-electron spectra of carbonyls and nitrosyls are reported. The mechanisms by which core holes produced by the photo-excitation are screened are discussed. The results for Ni(CO)4 and Cr(NO)4 are in excellent agreement with experiment. Dissert. Abstr.

N80-31230 Pennsylvania Univ., Philadelphia.
RESONANCES AND COLLECTIVE EFFECTS IN PHOTOEMISSION Ph.D. Thesis
Harry Jay Levinson 1980 175 p
Avail: Univ. Microfilms Order No. 8018572

Factors which determine the intensity of photoionization other than a system's initial state, in atoms, molecules, and solids were investigated. The effect of dielectric response on surface photoemission has been studied on Al(001). In a spectral region where the metal was far from transparent (near or below the bulk plasma frequency) a spatially varying photon field at the metal surface was found to contribute significantly to the photoionization cross section. The actual cross section was more than an order of magnitude larger than the inappropriate result obtained within the dipole approximation. This was ascertained by making an absolute determination of the photoionization cross section for the surface state and Fermi level on Al(001). A gas phase spectrometer capable of measuring angle-resolved cross sections was used to study asymmetry paramcters in N2 and branching ratios of the spin orbit split 5p level in xenon using synchrotron radiation. The affect of final state resonances on the photoionization cross section from SF6 were studied by a theoretical self consistent field X alpha calculation. A breakdown of the single particle picture was observed. Dissert. Abstr.

N80-31231 California Univ., Santa Barbara.
STUDY AND CHARACTERIZATION OF SEMICONDUCTOR SURFACES AND INTERFACES Ph.D. Thesis
John David Langan 1979 279 p
Avail: Univ. Microfilms Order No. 8019842

Indium antimonide surfaces were prepared with surface state densities less than 10 to the 10th power 2V/sq cm and without capacitance voltage hysteresis by preservation of the thin, natural oxide on the substrate surface. Quasi-static capacitance-voltage and conductance measurements were made on MOS structures. It is shown that apparent measurements on InSb structures of high surface state densities in capacitance and conductance techniques could be due to misinterpretation because of the presence of surface potential lateral inhomogeneity. The presence, chemical identification, and thickness of the natural oxide, both before and after the LTCVD process were independently confirmed by Auger electron spectroscopy and X-ray photoelectron spectroscopy. The oxidation state and resultant electrical properties are identified with changes in LTCVD reactor conditions. In general, the natural oxide composition is shown to be In2O3 and Sb2O3, although Sb oxide is removed during the LTCVD reaction, due to the volatility of Sb. The relative Sb/In ratio varies within the oxide, but generally is 0.25. Dissert. Abstr.

N80-31232 Michigan State Univ., East Lansing.
MICROSTRUCTURAL ASPECTS OF IMPACT OF EROSION IN LiF, NaCl, KCl AND CaF2 SINGLE CRYSTALS Ph.D. Thesis
Susan Roberta Schuon 1980 119 p
Avail: Univ. Microfilms Order No. 8020737

To clarify the fundamental mechanisms of material removal in erosion by solid particles entrained in a fluid stream impinging on a solid surface, single crystals were selected for targets in view of their precisely defined structure. The damage to the target by impact of a single particle ('single-impact mode') and by impact of a stream of particles ('multiple-impact mode') was

studied by scanning electron microscopy. In addition, the damage by multiple impact was assessed by measuring the erosion rate. In the single-impact mode, the damage is highly dependent on the mechanical properties of the target as chips spalled off or micromachined out in individual impacts. At normal impact, the predominant mechanism is intersecting fractures, but at impact angles away from the normal, micromachining appears. NaCl and KCl, and in fact becomes the major mechanism of material removal. In LiF, only a little micromachining occurs and in CaF2, none at all; hence in these materials, spalling is the controlling mechanism for loss in individual impacts. Dissert. Abstr.

N80-31233 North Carolina State Univ. at Raleigh.
COMPARISON OF ATOMIC CONCENTRATION PROFILES, DEFECT DENSITY PROFILES, AND TYPES OF MICROSTRUCTURAL DEFECTS IN GaAs ANNEALED AFTER IMPLANTATION WITH Be Ph.D. Thesis
Kae-Shyong Lee 1979 69 p
Avail: Univ. Microfilms Order No. 8020494

Semi-insulating chromium-doped GaAs was implanted with 100 keV Be ions to fluences of 5 x 10 to the 13th power and 1 x 10 to the 15th power ions/sq cm. Specimens were annealed at 800 C for thirty minutes. Beryllium atomic concentration profiles, as determined by secondary ion mass spectrometry, were compared to the defect profiles obtained from transmission electron stereomicroscopy techniques for the annealed samples. A major redistribution of Be was observed compared to the as-implanted distribution after annealing at the higher fluence, whereas only a slight redistribution of Be occurred for the lower fluence. A major difference in the defect density profiles was observed with the fluences used for this study in the region where the annealed specimens were compared. The distribution of defects throughout the implanted-annealed layer was examined using sectioned specimens. The distribution and size of defects appear to be directly influenced by the Be concentration and its associated implantation induced damage. In addition, chromium doped semi-insulation /001/ GaAs was annealed at elevated temperatures after implantation with a Be fluence of 1 x 10 to the 15th power ions/sq cm at 60 keV. Dissert. Abstr.

N80-31234 Stanford Univ., Calif.
ADLAYER EFFECTS ON THE SURFACE REACTIVITY OF W(100) AND Mo(100) SINGLE CRYSTALS Ph.D. Thesis
Edmond Ing-Ming Ko 1980 282 p
Avail: Univ. Microfilms Order No. 8016841

The surface reactivity of W(100) and Mo(100) single crystals with adsorbed carbon and oxygen was studied using flash desorption spectroscopy and temperature programmed reaction spectroscopy. Carbon and oxygen adatoms were deposited by the thermal cracking of ethylene and the chemisorption of molecular oxygen, respectively. For either adatom several ordered overlayers were observed as a function of coverage and temperature. The presence of either carbon or oxygen severely hindered the ability of W(100) and Mo(100) to dissociatively chemisorb hydrogen or carbon monoxide. In the case of carbon, a correlation was found between the available fourfold sites on the surface and the amount of carbon monoxide dissociated. The ability of the carbide surface to adsorb molecular carbon monoxide was not significantly affected. On the other hand, oxygen was found to suppress the chemisorption of molecular carbon monoxide at room temperature as it reduced the carbon monoxide binding energy considerably more than carbon. Dissert. Abstr.

N80-31235 Iowa State Univ. of Science and Technology, Ames.
RAMAN SCATTERING BY A MOLECULE ADSORBED AT THE SURFACE OF A THIN METALLIC FILM Ph.D. Thesis
Mark Francis Wright 1980 81 p
Avail: Univ. Microfilms Order No. 8019677

The Raman scattering cross section is calculated using standard third order perturbation theory. The scattering is viewed as a three-stage process: an electron-hole pair is created in the metal by the incident photon; the excited electron scatters off the molecule inelastically, exciting a molecular vibration; the electron finally recombines with the hole emitting the Raman scattered photon. The electrons in the film are confined by infinite potential barriers at the surfaces, but are otherwise free. The resulting sinusoidal one-electron eigenfunctions are used to calculate the nonlocal conductivity tensor in the random phase approximation. Maxwell's equations are then used to determine the vector potential inside the film, which allows the electron-photon matrix elements to be calculated. The electron-molecule interaction is deduced from experimental data on low energy inelastic electron scattering from polar molecules. Calculations are performed for the frequency dependence of the Raman cross section with two different film thicknesses. Dissert. Abstr.

N80-31236 Iowa State Univ. of Science and Technology, Ames.
ELECTRONIC BAND STRUCTURE AND OPTICAL PROPERTIES OF THE CUBIC Sc, Y AND La HYDRIDE SYSTEMS Ph.D. Thesis
Douglas Jay Peterman 1980 122 p
Avail: Univ. Microfilms Order No. 8019657

Self-consistent band calculations of ScH2 and YH2 were carried out using the Korringa-Kohn-Rostoker method. The respective joint densities of states were computed and compared to the dielectric functions determined from the optical measurements of Weaver, Rosei and Peterson. Additional calculations were performed in which the Fermi level or band gap energies were rigidly shifted by a small energy increment. These calculations were used to simulate the derivative structure in thermomodulation spectra and relate the origin of experimental interband features to the calculated energy bands. While good systematic agreement was obtained for several spectral features, the origin of low-energy interband transitions in YH2 cannot be explained by these calculated bands. Measurements of the optical absorptivity of LaH(x) with 1.6< x <2.9 are presented which, as expected, indicate a more premature occupation of the octahedral sites in the larger LaH2 lattice. These experimental results also suggest that, in contrast to recent calculations, LaH3 is a small-band-gap semiconductor. Dissert. Abstr.

N80-31237 California Univ., Santa Barbara.
SURFACE PLASMONS CONFINED BY MICROSTRUCTURES Ph.D. Thesis
Ronald Wallace Rendell 1979 174 p
Avail: Univ. Microfilms Order No. 8019845

Surface plasmons confined by microstructures on tunnel junctions are theoretically examined. A theory of surface plasmons excited by inelastic electron tunneling is formulated in a way which can be conveniently modified to take into account the effects of a random distribution of impurities in the counterelectrode. Two qualitatively different dispersion regimes found in the smooth junction surface plasmons suggest a convenient and natural division of possible microstructure excitations into two types: gap modes which are confined to a region beneath the microstructure, and rod modes which are confined to the bulk of the microstructure. The frequency, angular, polarization, and surface distribution dependence of optical emission by the rod and gap modes excited by inelastic tunneling are examined in detail. In addition, the cases of microstructures raised above a junction, superconducting microstructures, and microstructures in an external field are discussed. Dissert. Abstr.

N80-31238 California Inst. of Tech., Pasadena.
PHONON REFLECTION FROM CRYSTAL INTERFACES AND THE KAPITZA PROBLEM Ph.D. Thesis
Peter Taborek 1979 123 p
Avail: Univ. Microfilms Order No. 8020432

The heat pulse technique is used to study phonon reflection from sapphire-vacuum and sapphire-liquid helium interfaces. In order to interpret the complex time-of-flight spectra, the problem of the reflection of elastic waves in an anisotropic medium is analyzed in detail. The analysis shows that there are, in general, nine phonon reflection processes, each with a different time of flight, which transfer energy from heater to detector via a single reflection. Although the sharp features in the reflection signal due to specular (k micron conserved) processes can be explained using anisotropic elastic theory, approximately half the energy which reaches the detector arrives via nonspecular channels. The non-specular scattering, which may be due to surface roughness, gives rise to broad features in the signal. The main difference between crystal-vacuum and crystal-helium reflection signals is that the non-specular signal is much smaller for the helium covered surface. The specular signal is not affected by helium. Apparently, the non-specular processes are involved in the anomalous Kapitza conductance. A method of analyzing

phonon focusing based on an asymptotic analysis of the phonon Green's function is developed. Dissert. Abstr.

N80-31239 Pennsylvania Univ., Philadelphia.
STRUCTURAL AND ELECTRONIC PROPERTIES OF A *LINEAR CHAIN MERCURY COMPOUND* Ph.D. Thesis
Richard David Spal 1980 171 p
Avail: Univ. Microfilms Order No. 8018614

The quasi one dimensional metal consists of one dimensional lattices, or chains, of Hg atoms, periodically arrayed in channels along the a and b axes of a three dimensional, tetragonal host *lattice of AsF6(-) octahedra. The primary properties investigated* were X-ray scattering, dc conductivity and Hall effect, and the Meissner effect. The *compound exhibits usual type 1 superconductivity, and unusual, anisotropic superconductivity at low temperatures.* Meissner effect observations demonstrate type 1 superconductivity with a critical temperature of 43 K and a critical field of about 20 G. Between .43 and 4.1 K, conductivity and magnetization measurements reveal anisotropic superconductivity, *with a critical field curve similar to that of Hg. Detailed analysis* of the data shows that the origin of the anisotropic superconductivity is not surface Hg, as proposed in the literature, nor Hg *inclusions with minimum dimensions of at least 1 micron but* may be smaller inclusions which are strongly influenced by the proximity effect. Dissert. Abstr.

N80-31240 Cornell Univ., Ithaca, N. Y.
DIFFUSION INDUCED GRAIN BOUNDARY MIGRATION IN *Au-Cu AND Au-Ag THIN FILMS* Ph.D. Thesis
Ju-Don Pan 1980 142 p
Avail: Univ. Microfilms Order No. 8020865

Diffusion induced grain boundary migration was studied by employing Au-Cu and Au-Ag thin film specimens. The results support the conclusion that this phenomenon is widespread and that it can lead to boundary migration and bulk composition change under conditions where neither is expected. Two *approaches were employed to study this phenomenon.* In the first approach polycrystalline gold thin films were coated with either copper or silver layers annealed and etched in an appropriate acid bath to strip off the copper or silver layers. The microstructure and the chemical composition of these alloy zones, were studied by means of both transmission electron microscopy and scanning transmission electron microscopy. In the second approach coated gold thin films were depth profiled by combined Auger Electron Spectroscopy and Xe Ion Sputtering. In both approaches, it was observed that the boundary migration rate decreased as the migration proceeded. Dissert. Abstr.

N80-31241# Royal Aircraft Establishment, Farnborough (England).
LIQUID CRYSTALS (NEMATIC LIQUIDS)
K.-H. Walter, W. Geffecken, and W. Geubel 30 Oct. 1979 94 *p refs Transl. into ENGLISH of "Flussige Kristalle (Nematische* Flussigkeiten)", Rept. BMFT-FB-T-76-71 Siemens A.G., Munich, 1976
(RAE-Lib-Trans-2020; BR72936; BMFT-FB-T-76-71) Avail: NTIS HC A06/MF A01

The development of a screen matrix with liquid crystals is described. The starting point was primarily a matrix concept that envisaged auxiliary elements for the decoupling. However, the concept of using liquid crystals capable of storage proved to be more advantageous in regard to actual realization and the attainment of higher resolution. The end result of the work is a matrix consisting of 16,000 image-pints (each 0.5 x 0.5 sq mm) that utilizes the bistability effect, is suited to the representation of graphical data or alphanumeric symbols, and operates in an erase-write action. Circuit concepts for the integration of the driver elements are worked out. The technological problems associated with the Matrix as well as with general liquid crystal displays (such as surface purification, surface orientation, sealing techniques, and aging processes) are treated. L.F.M.

N80-31242*# Rockwell International Corp., Thousand Oaks, Calif. Electronics Research Center.
EPITAXIAL GROWTH OF SINGLE CRYSTAL FILMS Final Report, 4 Oct. 1975 - 31 May 1980
M. D. Lind May 1980 36 p refs
(Contract NAS8-31733)
(NASA-CR-161544; ERC41001.30FR) Avail: NTIS HC A03/MF A01 CSCL 20L

An experiment in gallium arsenide liquid phase epitaxy was performed successfully on the SPAR 6 flight October 17, 1979. The design, fabrication, and testing of the experimental apparatus, *and the performance and results of the experiment are dis-*cussed. Author

N80-31243# *Marquette Univ., Milwaukee, Wis. Dept. of* Physics.
ELECTRICAL CHARACTERIZATION OF GERMANIUM IMPLANTED GALLIUM ARSENIDE Final Report, 1 Jun. 1979 - 31 May 1980
Frank L. Pedrotti 2 Jun. 1980 8 p refs
(Grant AF-AFOSR-0113-79; AF Proj. 2306)
(AD-A086652; AFOSR-80-0462TR) Avail: NTIS *HC A02/MF A01 CSCL 20/12*

The amphoteric electrical properties of germanium single implants into gallium arsenide, and of dual implants of germanium *with either gallium or arsenic into gallium arsenide, have been* studied. Room temperature implantation was performed for all implanted ions at 120 keV, with doses ranging from 5E12 to *3E15 ions per square centimeter. Implanted samples were* annealed with pyrolytic silicon nitride encapsulants at temperatures ranging from 700 to 1000 degrees Celsius. Both p- and n-type *layers were observed. Type of conductivity, electrical activation,* and carrier mobility were found to depend critically upon ion dose and anneal temperature. The general electrical behavior *suggests that in samples of lower dose and anneal temperature,* the implanted Ge ions go into As sites preferentially, producing p-type activity, whereas in samples of higher dose and anneal *temperature, more Ge ions go into Ga sites, producing n-type* activity. Conductivity was found to change from p- to n-type at *an intermediate dose of 3E14 ions per square centimeter and* at an anneal temperature between 900 and 950 degrees Celsius. It has been determined that additional implantation of As into GaAs Ge favors Ge occupancy of Ga sites and an enhancement of n-type activity, whereas the additional implantation of Ga encourages Ge occupancy of As sites and an enhancement of p-type activity. Enhancement factors of as much as 8 for p-type activations, and as much as 50 for n-type activations have been measured. GRA

N80-31244# Varian Associates, Palo Alto, Calif. Solid State Lab.
SUBMICRON FETS USING MOLECULAR BEAM EPITAXY Annual Report, Aug. 1978 - Aug. 1979
S. Bandy, D. Collins, and C. Nishimoto Aug. 1979 44 p refs
(Contract N00014-77-C-0655; RF625B1001)
(AD-A086422; AR-2) Avail: NTIS HC A03/MF A01 CSCL 20/12

Electron-beam exposure and MBE material have been used to achieve quarter-micron gate length GaAs FETs. A noise figure of 1.5 dB with an associated gain of 15 dB has been measured at 8 GHz. GRA

N80-31245# Motorola, Inc., Scottsdale, Ariz. Government Electronics Div.
DOUBLY ROTATED CUT SAW DEVICES Interim Report, 15 Aug. 1979 - 1 Mar. 1980
D. F. Williams and F. Y. Cho Jun. 1980 113 p refs
(Contract DAAK20-79-C-0275)
(AD-A086734; DELET-TR-79-0275-1; IR-1) Avail: NTIS HC A06/MF A01 CSCL 20/2

The objective of this program is the exploratory development of doubly rotated cuts of quartz possessing superior Surface Acoustic Wave (SAW) properties for applications involving environmentally hardened devices. The key properties examined and optimized both theoretically and experimentally are: first, second and third order Temperature Coefficients of Delay (TCD), piezoelectric coupling factor, power flow angle, Bulk Acoustic Wave (BAW) inverse velocity surfaces, degeneracies and leaky waves, and sensitivities of the above quantities to misorientations and manufacturing tolerances. The program consists of two major task areas comprising an interactive numerical/experimental approach. Task 1 involves the numerical computation of the key SAW properties for doubly rotated quartz substrates for the purpose of locating promising angular ranges with properties

superior to the singly rotated cuts now in existence. More detailed calculations follow to refine the angular coordinates in order to specify cuts for experimental verification in Task 2. In Task 2, sets of substrates with promising orientations identified in Task 1 will be prepared and SAW device patterns will be fabricated for evaluation of the key SAW properties. The experimental results of this task will be correlated with the theoretical predictions and an iterative process develops for refinement of both theoretical and experimental parameters. As the program proceeds, working SAW device models will be delivered as a demonstration of progress and an indication of the future potential of the doubly rotated cuts. GRA

N80-31246# Litton Systems, Inc., Morris Plains, N. J. Airtron Div.

THE GROWTH OF BERLINITE (AlPO4) SINGLE CRYSTALS Final Report, 1 Jul. 1977 - 30 Sep. 1979

Larry E. Drafall and Roger F. Belt Mar. 1980 75 p refs

(Contract F19628-77-C-0213)

(AD-A086751; RADC-TR-80-73) Avail: NTIS HC A04/MF A01 CSCL 20/2

Single crystals of the berlinite mineral phase of anhydrous aluminum orthophosphate have been grown for possible surface acoustic wave applications. The desired piezoelectric form of AlPO4 is the alpha-phase which is stable from 130 to 580 C. A seeded hydrothermal growth technique was used. Nutrient was prepared by heating hydrated alumina and phosphoric acid in a sealed silver liner from 140 to 200 C at a rate of 5 deg/day and a 15 deg temperature gradient. Because AlPO4 has retrograde solubility, the nutrient was placed in a silver mesh basket in the upper, cooler portion of the liner with the seeds situated in the lower, hotter portion. A 20% free area baffle separated the two regions. Two basic techniques were used for the growth runs. The constant temperature method with a 10 C gradient produced rates of 23-25 mils/day. The rates could be varied significantly depending on such parameters as growth temperature, gradient, nutrient basket mesh size, seed orientation and baffle design. The second technique used increasing temperature at a rate of 5 C/day over the range of 140-200 C to obtain average growth rates of 22-32 mils/day. Seed orientation for most runs was (0001) plates. New growth of AlPO4 for the most part was clear and of fair quality. GRA

N80-31247# Cornell Univ., Ithaca, N. Y.

GROWTH OF GRAIN BOUNDARY CAVITIES UNDER APPLIED STRESS AND INTERNAL PRESSURE

James F. Mancuso (Combustion Engineering, Windsor, Conn.) and Che-Yu Li 1980 21 p refs

(Contract EY-76-S-02-2172)

(COO-2172-26) Avail: NTIS HC A02/MF A01

The growth of grain boundary cavities in nickel under internal pressure and applied stress is investigated. Under the experimental conditions, the growth kinetics was found to be controlled by stress induced mass transfer. The growth rate was found not to be a linear function of the applied stress. The growth rate was found to depend on grain boundary orientation and grain boundary sliding. DOE

N80-31248# Air Force Materials Lab., Wright-Patterson AFB, Ohio. Solid State Physics Research Lab.

IMPURITY STUDIES IN THE SINGLE CRYSTAL CADMIUM SULFIDE Final Report, 1966 - 1974

Lawrence C. Greene Dec. 1979 125 p refs

(AF Proj. 7885)

(AD-A086741; AFML-TR-79-4104) Avail: NTIS HC A06/MF A01 CSCL 20/2

In cadmium sulfide crystals, an easily observed and measured phenomenon is the low temperature bound exciton emission spectrum. The spectral lines are sharp, and their wavelength can be measured with considerable precision. The spectral position of the lines in a magnetic field can tell us much about the symmetry and structure of the center. The purpose of this work was to establish a relationship between the bound exciton spectra and defect or impurity structure of the crystal. A line associated with a neutral donor and a pair of lines associated with an ionized donor were found for the very purest material. A neutral donor was found for crystals equilibrated in hydrogen, and a pair of ionized donors for material equilibrated in hydrogen sulfide. Lithium doped crystals showed several pairs of ionized donor lines as well as a large number of characteristic neutral donor lines. Silver doping produced a large number of characteristic lines, but the nature of the associated centers has not been established. Sodium showed many characteristic lines, some associated with neutral donors, some with ionized donors, as well as lines clearly associated with complex structures. Potassium and rubidium both showed characteristic ionized donor lines. GRA

N80-31249# Rockwell International Corp., Anaheim, Calif. Electronic Devices Div.

GaAs SURFACE EFFECTS Interim Technical Report, 1 Jul. 1978 - 1 Jul. 1979

G. Kinoshita and Gordon G. Kuhlmann Wright-Patterson AFB, Ohio AFWAL Mar. 1980 61 p refs

(Contract F33615-78-C-1591; AF Proj. 2305)

(AD-A087033; C79-1032/501; AFWAL-TR-80-1018) Avail: NTIS HC A04/MF A01 CSCL 07/4

This report presents the results of the first six months of a program to investigate the passivation of GaAs surfaces using a native insulator. Ion implantation of phosphorus and subsequent oxidation of the surface was used to form the insulator. Post-implant annealing indicates that CVD SiO2 has somewhat better encapsulating properties than sputtered Si3N4. It was found that high dose phosphorus implantation significantly reduces decomposition of the semiconductor surface under the SiO2 encapsulant during high temperature annealing. Ion microprobe analysis of the implant profiles indicate that phosphorus diffusion is not significant during either high temperature annealing or oxidation. Elemental depth profiles of oxide layers indicate phosphorus incorporation into the film in the region from the peak of the implant to the interface with the semiconductor. A lack of arsenic and phosphorus at the oxide surfaces indicates that this region may be composed primarily of Ga2O3. GRA

N80-31250# New Univ. of Ulster, Coleraine (Northern Ireland). School of Physical Sciences.

GROWTH AND APPLICATION OF CADMIUM TELLURIDE Final Technical Report, Feb. 1977 - Jan. 1980

R. H. Williams and M. H. Patterson Jan. 1980 171 p refs

(Grant DA-ERO-77-G-026; DA Proj. 1T1-61102-BH-57)

(AD-A086991) Avail: NTIS HC A08/MF A01 CSCL 20/2

Large Single Crystals of CdTe were grown by the methods of Liquid Encapsulated Czochralski, Fast Vertical Bridgman, Travelling Heater Method, Stockbarger method. Electrical characterization was done by Seebeck, Hall Effect and Conductivity measurements. Surfaces were investigated using XPS, UPS, AES and LEED. Metal-CdTe contacts were fabricated. Formation of these was monitored using XPS, UPS, LEED, AES. Barrier Heights were established by I-V, C-V and UPS measurements. Results show that the effect of the CdTe surface on the type of contact formed is very marked. GRA

N80-31251# Naval Research Lab., Washington, D. C. Solid State Devices Branch.

GaAs FET DEVICE FABRICATION AND ION IMPLANTATION TECHNOLOGY Summary Report, 1 Oct. 1978 - 30 Sep. 1979

Kenneth J. Sleger and Harry B. Dietrich 25 Jun. 1980 26 p refs

(ZF54581001)

(AD-A087004; AD-E000481; NRL-MR-4263) Avail: NTIS HC A03/MF A01 CSCL 09/1

Microwave device fabrication and evaluation in conjunction with ion implantation has been selected to provide a benchmark technology for evaluation of semi-insulating GaAs and InP grown at NRL and elsewhere. Devices have been processed by a combination of conventional contact photolithography and liftoff techniques to achieve geometries with linewidths as small as 0.8 microns. A plasma deposited layer of Si3N4 has been employed as an annealing encapsulant at temperatures between 800 C and 850 C for 15-30 minutes (GaAs) or 700 C - 750 C for 15 minutes (InP). Si and Se were used as the principal implant species. During this period, the Si3N4 encapsulation process and the fabrication of GaAs FETs with one micron gate lengths and noise figures below 2.4 dB at 6 GHz have become routine. Difference in microwave performance between ion

implanted channel and epitaxial channel (industrially supplied) GaAs FETs was systematically correlated with various materials parameters such as mobility and light sensitivity and with static FET characteristics such as looping, backside gating, pinch-off voltage and transconductance. Experimental results indicate that good microwave performance can be obtained even though a few of the static or material characteristics are independently judged to be substandard. GRA

N80-31252# Los Alamos Scientific Lab., N. Mex.
ELECTRON RESPONSE THEORY OF LATTICE VIBRATIONS: EMERGENCE OF CONCEPTS AND A GLANCE AT THE FUTURE
D. C. Wallace 1980 21 p refs Presented at Condensed Matter Div. of European Phys. Soc. Conf., Antwerp, 9-11 Apr. 1980
(Contract W-7405-eng-36)
(LA-UR-80-1000; CONF-800468) Avail: NTIS HC A02/MF A01

Lattice dynamics, the theory of phonons, is historically reviewed. Electronic structure solids and superconductivity are discussed. Speculations on the future of solid state physics are presented. E.D.K.

N80-31253# Oak Ridge National Lab., Tenn.
ADVANCED DESIGNS FOR HIGHLY STABLE SUPERCONDUCTOR SYSTEMS
J. W. Lue and J. R. Miller 1979 11 p refs Presented at 8th Symp. on Eng. Probl. of Fusion Res., San Francisco, 13 Nov. 1979
(Contract W-7405-eng-26)
(CONF-791102-148) Avail: NTIS HC A02/MF A01

A basic conductor design is given to take advantage of the enhanced stability of cable-in-conduct conductors brought about by transient pressure waves in helium. The design is discussed in terms of manufacturability, performance, and applicability in large fusion magnets. A few small scale test conductors have been constructed. Preliminary test results on the performance of one of them is included. Possible variations offered by the flexibility of the basic design is also discussed. DOE

N80-31254# Oak Ridge National Lab., Tenn. Solid State Div.
CRYSTAL DEFECT STUDIES USING X-RAY DIFFUSE SCATTERING
1980 19 p refs Presented at Am. Inst. of Metal. Engr. Meeting, Las Vegas, Nev., Feb. 1980
(Contract W-7405-eng-26)
(CONF-800205-7) Avail: NTIS HC A02/MF A01

The effect of interruptions of the crystal lattice on the scattering of X-rays is considered, and examples are presented of the use of the diffuse scattering to study the defects. X-ray studies of self-interstitials in electron irradiated aluminum and copper are discussed in terms of the identifications of the interstitial configuration. Methods for detecting the onset of point defect aggregation into dislocation loops are considered and techniques for determination of separate size distributions for vacancy loops and interstitial loops are presented. Direct comparisons of dislocation loop measurements by X-rays with existing electron microscopy studies of dislocation loops indicate agreements of large size loops, but X-ray measurements report higher concentration in the smaller loop range. Methods for distinguishing between loops and three dimensinal precipitates are discussed and possibilities for detailed studies considered. DOE

N80-31255# Motorola, Inc., Phoenix, Ariz. Semiconductor Group.
SEQUENTIAL PURIFICATION AND CRYSTAL GROWTH FOR THE PRODUCTION OF LOW COST SILICON SUBSTRATES Quarterly Technical Progress Report, 15 Sep. - 31 Dec. 1979
Ming Liaw, Frank Secco, Bill Ingle, and Don Down Feb. 1980 42 p refs
(Contract EG-77-C-01-4042)
(DOE/SERI-8119-3/1; QTPR-1) Avail: NTIS HC A03/MF A01

The direct purification of MG-Si is being investigated. A unique characteristic of the approach used by this project is the use of a crystal puller to perform both purification and crystal growth. Sequential steps of purification were taken. By the completion of this series of purification, the purified MG-Si melt will be further purified by impurity redistribution using ingot pulling. The final purified silicon will be in an ingot form of desired dimensions for slicing into silicon sheets. The sequential steps of purification include: (1) leaching of MG-Si charge, (2) phase separation, (3) reactive gas treatment, (4) liquid-liquid extraction (called Slagging), and (5) purification by redistribution of impurities using ingot pulling. Progress on items (1) and (2) is reported. DOE

N80-31256# Ames Lab., Iowa. Dept. of Materials Science, Engineering and Physics.
ELECTRONIC STRUCTURE STUDIES OF METAL HYDRIDES
J. H. Weaver, D. T. Peterson, and D. J. Peterman 1980 23 p refs Presented at the Intern. Symp. on the Properties and Appl. of Metal Hydrides, Colorado Springs, 7 Apr. 1980 Prepared in cooperation with Wisconsin Univ., Stoughton
(Contract W-7405-eng-82)
(ISM-265; CONF-800402-1) Avail: NTIS HC A02/MF A01

Representative metal hydrides were examined through photoelectron and optical spectroscopies. The results are compared with predictions of the one-electron band model for the various metal-hydrogen systems. Generally excellent agreement is found. The discussion emphasizes Nb4H3 and the dihydrides of Sc, Y, Nd, Gd, Tb, Er, Lu, Hf, and Th. DOE

N80-31257# Ames Lab., Iowa. Dept. of Materials Science, Engineering and Physics.
OPTICAL AND PHOTOEMISSION STUDIES OF LANTHANUM HYDRIDES
D. J. Peterson and J. H. Weaver 1980 14 p refs Presented at the Intern. Symp. on the Properties and Appl. of Metal Hydrides, Colorado Springs, 7 Apr. 1980 Prepared in cooperation with Wisconsin Univ., Stoughton Sponsored in part by NSF
(Contract W-7405-eng-82)
(ISM-264; CONF-800402-5) Avail: NTIS HC A02/MF A01

The results of optical absorptivity and photoemission measurements on lanthanum hydrides. LaH/sub x/(1.98 < or = x < or = 2.89) are reported. The low energy (< or = 0.5 eV) optical features in LaH/sub x/ are attributed to the filling of octahedral sites. Higher energy interband absorption involves states within the d band complex, analogous to other dihydrides. As x increases above 2.0, the optical features change rapidly due to the increase in the number of occupied octahedral sites. Various band structure studies suggest that LaH3 might be a semiconductor. Photoemission results show that as x increases, the d derived states at E/sub F/ are drawn down and that for LaH2 only very weak valence band emission is observed. The hydrogen derived bonding bands are shown centered approximately 5 eV below E/sub F/. Observed chemical shifts in the La 5p/sub 1/23/2/ cores are discussed for 1.98 < or = x < or = 2.89. DOE

N80-31258# Ames Lab., Iowa. Dept. of Physics.
METAL-ELECTROLYTE BOUNDARY STUDIES WITH IN SITU PHOTOEMISSION
D. E. Grider and T. E. Furtak 1980 18 p refs Presented at the Conf. on Non-traditional Approaches to the Study of the SolidElectrolyte Interface, Snowmass, Colo., 23 Sep. 1979
(Contract W-7405-eng-82)
(ISM-257; CONF-790956-5) Avail: NTIS HC A02/MF A01

The boundary between copper (111) and 0.5 M H2SO4 is investigated using interfacial photoemission spectroscopy. Exploiting knowledge of electron momentum restrictions a feature in the ratio of p-polarized to s-polarized photoelectron yield was correlated with the onset of transitions to Bloch-like final states within the metal at 4.1 eV. This provide some energy specification in the electron energy integrated yield data. The quality of the interface was monitored using both clean and adsorbate (thiourea) covered Cu surfaces. The major effect of adsorption is attributed to a loss of conversation of electron momentum parallel to the surface during the emission process. DOE

N80-31258# Istituto Superiore di Sanita, Rome (Italy).
MOLECULAR REORIENTATIONS IN LIQUID CRYSTALS. THE 13 C -/1H/ NUCLEAR OVERHAUSER EFFECTS IN LIQUID MBBA
L. Radics (Central Research Inst. of Chemistry, Budapest, Hungary) and P. L. Indovina 4 Jun. 1979 30 p refs Sponsored by Italian National Research Council
(ISS-P-79/4) Avail: NTIS HC A03/MF A01

High resolution 13 C, 1H spin-lattice relaxation times (T(1)C, T(1)H) and 13 C-/1H/ nuclear Overhauser enhancement factors (NOEF) were measured at 25 MHz (T(1)C) as well as at 100 MHz (T(1)H) for the nematic liquid crystal N-(p-methoxybenzilidene)-p-n buthylaniline (MBBA) over the nematic-isotropic transition between 43 and 75 C. Most of the carbon atoms in the molecule exhibit highly reduced NOEEs indicating the presence of slow motions affecting the T(1) processes. On the basis of dilution experiments, the low frequency motions can be attributed to the overall reorientation of the molecule. Estimates of the respective correlation time give 2 nanosec which is an order of magnitude larger than the value currently accepted for this motion. It is shown that a model of slow overall reorientation and fast multiple internal rotation of groups can adequately explain the temperature dependence of the relaxation parameters and predict a substantial contribution to the frequency dependence of proton spin lattice relaxation time down to the MHz range. Author (ESA)

N80-31260# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
MEASUREMENT OF THE ENERGY DEPENDENCE OF THE INTEGRAL SCATTERING CROSS SECTION FOR ELECTRONIC STIMULATION IN SHOCKS OF ALKALI WITH MERCURY, WITH SPECTRAL ANALYSIS OF LIGHT Thesis [MESSUNG DER ENERGIEABHAENGIGKEIT DES INTEGRALEN STREUQUERSCHNITTS FUER ELEKTRONISCHE ANREGUNG IN STOESSEN VON ALKALIEN MIT QUECKSILBER MIT SPEKTRALER ANALYSE DES LICHTES]
Udo Krause Sep. 1979 125 p refs In GERMAN
(MPIS-17/1979; ISSN-0436-1199) Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 21,60

An integral scattering experiment was performed with the measurement of the electronic stimulation of alkalies (Na, K, Rb) in the case of collisions with mercury. The energy field from 20 to 1400 eV was studied. Other measurements were made of integral cross section for the light emission in case of collisions of the three alkalies with CO2. The measurement were interpreted using adiabetic potential curves and with a comparison with quantum mechanics calculations. Author (ESA)

N80-31261# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
STUDY OF THE ANISOTROPIC POTENTIAL OF KCl AND CsCl IN A ROTATION INELASTIC COLLISION WITH RARE GASES. PART A: STUDY OF THE QUADRUPOLE MOMENT OF MOLECULES FROM ROTATION INELASTIC SCATTERING CROSS SECTIONS OF CsF Thesis - Bonn Univ. [A. UNTERSUCHUNG DES LANGREICHWEITIGEN, ANISOTROPEN POTENTIALS VON KCL UND CSCL BEI ROTATIONSINELASTISCHEN STOESSEN MIT EDELGASEN. B. ERMITTLUNG DER QUADRUPOLMOMENTE VON MOLEKUELEN AUS ROTATIONSINELASTISCHEN STREUQUERSCHNITTEN DES CSF]
Gerhard Meyer Oct. 1979 150 p refs In GERMAN
(MPIS-19/1979-Pt-A) Avail: NTIS HC A07/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 25,80

The reversible potential for rotation inelastic shocks between molecules and atoms is studied. Some physical qualities such as the quadrupole moment of molecules with well known electrostatic potential are presented. Author (ESA)

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

N80-31262 Johns Hopkins Univ., Baltimore, Md.
THERMODYNAMICS BASED ON A WORK INEQUALITY Ph.D. Thesis
Chi-Sing Man 1980 147 p
Avail: Univ. Microfilms Order No. 8020258

An attempt is made to extend Truesdell's work estimate (W sub 0) by seeking appropriate quantities, namely, 'the cumulative heat received' C+, and the temperatures theta(+) sub s, theta(-) sub i to replace 'the heat absorbed' C, and the temperatures theta(max), theta(min) respectively, in (W sub 0) so that the resulting estimate (W) is appropriate to inhomogeneous process and when restricted to homogeneous processes is equivalent to (W sub 0). For a body B which undergoes a thermodynamic process in a time interval T, the work estimate (W) is postulated to hold for every part P of B and for every subinterval of T. This postulate is called the fundamental work inequality (W), and the continuum thermodynamics is studied for when the Clausius-Duhem inequality is replaced by the postulate (W). Since most of the objections against basing thermodynamics on the Clausius-Duhem inequality remain if by (W), it is not claimed that (W) is the final form of the Second Law in continuum thermodynamics. Rather, (W), as a replacement for the Clausius-Duhem inequality, is taken as an intermediate step in the program of making the second generic principle of continuum thermodynamics a statement regarding heat and work. Dissert. Abstr.

N80-31263# Los Alamos Scientific Lab., N. Mex.
NON-ADIABATIC MASS PARAMETERS
G. Schuette 1980 4 p refs Presented at Workshop on Nucl. Dyn., Granlibakken, Calif., 17-21 Mar. 1980
(Contract W-7405-eng-36)
(LA-UR-80-1020; CONF-800363-1) Avail: NTIS HC A02/MF A01

A fissioning nucleus is described by a Hamiltonian consisting of the kinetic energy, a single particle potential and a pairing force. The solution of the time dependent Schroedinger equation is obtained for a nucleus starting in the BCS ground state. DOE

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N80-31264# General Accounting Office, Washington, D. C. Financial and General Management Studies Div.
WIDER USE OF BETTER COMPUTER SOFTWARE TECHNOLOGY CAN IMPROVE MANAGEMENT CONTROL AND REDUCE COSTS Report to the Congress
29 Apr. 1980 67 p refs
(PB80-178254; FGMSD-80-38) Avail: NTIS HC A04/MF A01 CSCL 05A

Because the Federal Government spends billions of dollars annually on computer progams, GAO made this review to determine if the latest tools and techniques were being used to

develop and maintain those programs. Computer specialists at many agencies were unaware of the newer, better methods; others were reluctnat to change to them. The Government can improve management control and save significant amounts through appropriate use of better software tools and techniques. GAO recommends various ways to promote such use. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N80-31285# Sandia Labs., Albuquerque, N. Mex. Computer Aids Systems Development.
INVESTIGATION INTO INTERACTIVE GRAPHICS DATA BASE EXCHANGE VIA GERBER DATA
Robert E. Parks Mar. 1980 18 p
(Contract EY-76-C-04-0789)
(SAND-80-0588) Avail: NTIS HC A02/MF A01

The use of the Gerber language as a common data form through which design data could be exchanged between unlike systems is examined. Applicon Graphic System was used cyclically to check retention or degeneration of the data integrity when the original design was extracted/defined in the Gerber language and reentered into the AGS utilizing various Gerber interface Programs. Even though plots of the files appear very similar, the individual data bases are very dissimilar. Programs, both present and future, that might supply needed information or design aids and characteristics would find it virtually impossible to do so from a data base lacking the sophistication and completeness of the original AGS data base. Man machine hours required to bring the data base back to original quality would be extensive. The loss of data base integrity shown by this study was restricted to an AGS to AGS transfer. The loss could very easily be magnified if the transfer were between unlike systems. DOE

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N80-31286# Committee on Commerce, Science, and Transportation (U. S. Senate).
NASA AUTHORIZATION FOR FISCAL YEAR 1981. PART 4: INDEX
Washington GPO 1980 115 p Hearing on S. 2238 and S. 2240 before the Subcomm. on Sci., Technol., and Space of the Comm. on Com., Sci., and Transportation, 96th Congr., 2d Sess., 1980
(GPO-65-791) Avail: Subcommittee on Science, Technology, and Space

An index is presented for the U. S. Senate hearing to authorize a supplemental appropriation to the National Aeronautics and Space Administration for fiscal year 1981. L.F.M.

N80-31287# Committee on Appropriations (U. S. Senate).
DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT INDEPENDENT AGENCIES APPROPRIATION BILL, 1981
Washington GPO 4 Sep. 1980 139 p Report to accompany H. R. 7631 presented by the Comm. on Appropriations at the 96th Congr., 2d Session., 23 Jan. 1979
(S-96-926) Avail: US Capitol, Senate Document Room

A Senate committee report on a bill authorizing appropriations for the Department of Housing and Urban Development and various independent agencies for the fiscal year ending September 30, 1981 is presented. Amendments and an explanation of the contents of the bill are included. L.F.M.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation, and 44 Energy Production and Conversion*.

N80-31268*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A STUDY OF A SPACE COMMUNICATION SYSTEM FOR THE CONTROL AND MONITORING OF THE ELECTRIC DISTRIBUTION SYSTEM. VOLUME 1: SUMMARY Final Report
A. Vaisnys May 1980 54 p refs
(Contracts NAS7-100; DE-AI01-79ET-29372)
(NASA-CR-163477; JPL-Pub-80-48-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 13F

It is technically feasible to design a satellite communication system to serve the United States electric utility industry's needs relative to load management, real-time operations management, remote meter reading, and to determine the costs of various elements of the system. A definition of distribution control and monitoring functions is given. Associated communications traffic is quantified. A baseline conceptual design in terms of operating capability and equipment is described, important factors to be considered in designing a system are examined, and preliminary cost data are provided. Factors associated with implementation are discussed and conclusions and recommendations are listed. R.K.G.

N80-31269*# National Aeronautics and Space Administration, Washington, D. C.
NASA PROGRAM PLAN Fiscal Years, 1981 - 1985
Jan. 1980 233 p
Avail: NTIS HC A11/MF A01 CSCL 05A

Major facts are given for NASA'S planned FY-1981 through FY-1985 programs in aeronautics, space science, space and terrestrial applications, energy technology, space technology, space transportation systems, space tracking and data systems, and construction of facilities. Competition and cooperation, reimbursable launchings, schedules and milestones, supporting research and technology, mission coverage, and required funding are considered. Tables and graphs summarize new initiatives, significant events, estimates of space shuttle flights, and major missions in astrophysics, planetary exploration, life sciences, environmental and resources observation, and solar terrestrial investigations. The growth in tracking and data systems capabilities is also depicted. A.R.H.

N80-31270# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
HYBRID VEHICLE POTENTIAL ASSESSMENT. VOLUME 3: PARALLEL SYSTEMS
S. P. DeGrey 30 Sep. 1979 60 p
(Contract EM-78-I-01-4209)
(CONS-4209-T1-Vol-3) Avail: NTIS HC A04/MF A01

The hybrid vehicle type is characterized by arrangement of the heat engine and electric motor in the power train such that a direct mechanical or fluid mechanical power path from both the motor and engine to the wheels is available. Out of the several possible component arrangements that could satisfy these

requirements, a configuration in which the engine and motor are mounted in tandem, driving a 4 speed manual transmission, was selected for extensive computer analysis. Simulation of all the identified missions were run for this parallel hybrid configuration. For each mission, the battery mass fraction which is defined as the ratio of the battery mass to the gross vehicle weight (expressed in percent) was varied from 5 to 30%. These vehicles were designed such that the total energy usage of the battery before cut off would be about 80% of the C/3 discharge rate.
DOE

N80-31271# Aerospace Corp., El Segundo, Calif. Energy Conservation Directorate.
STUDY OF HYDROGEN-POWERED VERSUS BATTERY-POWERED AUTOMOBILES
J. J. Donnelly, Jr. (Escher Technology Associates), W. J. D. Escher, W. C. Greayer, and R. J. Nichols May 1979 79 p refs
(Contract EM-78-C-03-2184)
(ATR-79(7759)-1-Vol-1) Avail: NTIS HC A05/MF A01

Potential vehicle characteristics were identified for two candidate automobile propulsion systems. The first vehicle system employs a gaseous, hydrogen-fueled, internal combustion engine and either a liquid or metal hydride energy storage system. The second vehicle system employs an electronically controlled, electric motor power-train and a battery energy storage system. Tasks performed included in the technical and economic assessment of the state of the art and future alternatives in hydrogen production and delivery, the hydrogen vehicle assment, the battery-electric vehicle assessment, and the comparison of the principal vehicle alternative in 1985, 1990, and 2000. The comparison included weight, size, cost, energy, and design range relationships and the implications on expenditure of all major energy sources. Results are presented, and conclusions are drawn. Comments are made on the future roles of hydrogen and electricity in automobile propulsion.
DOE

N80-31272# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ELECTRIC AND HYBRID VEHICLE SYSTEM RESEARCH AND DEVELOPMENT PROJECT: HYBRID VEHICLE POTENTIAL ASSESSMENT. VOLUME 1: SUMMARY
Frank T. Surber 30 Sep. 1979 70 p refs 10 Vol.
(Contract EM-78-I-01-4209)
(CONS-4209-T1-Vol-1) Avail: NTIS HC A04/MF A01

The potential of hybrid vehicles as a replacement of the conventional gasoline or diesel fueled internal combustion engine vehicle within the next 20 to 30 yr are considered. Hybrid vehicle designs and applications which are technically and economically viable are discussed. Critical technical areas where research and development can be most usefully concentrated are identified.
R.C.T.

N80-31273# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ELECTRIC AND HYBRID VEHICLE SYSTEM RESEARCH AND DEVELOPMENT PROJECT, HYBRID VEHICLE POTENTIAL ASSESSMENT. VOLUME 4: SERIES SYSTEMS
Z. Popinski 30 Sep. 1979 76 p 10 Vol.
(Contract EM-78-I-01-4209)
(CONS-4209-T1-Vol-4) Avail: NTIS HC A05/MF A01

An evaluation of the series configuration is presented. The series configuration has the advantage that the engine is mechanically uncoupled from the wheels and can be operated at its best economy point much of the time. The mechanical energy produced by the engine is converted through a generator into electrical energy which is used to drive the motor or charge the batteries. This configuration offers a good degree of flexibility. It has the disadvantage that substantial losses of energy occur since the mechanical energy from the engine passes through several components before being used to drive the wheels. The energy produced by the engine is reduced by the product of efficiencies of components connected in series. Trade-offs involved in the study of the series configurations were directed toward establishing the size of the engine, motor and generator to meet vehicle acceleration performance; determining what level to operate the engine, and determining when to use the battery. These results were then used in the electric range simulation.
DOE

N80-31274# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ELECTRIC AND HYBRID VEHICLE SYSTEM RESEARCH AND DEVELOPMENT PROJECT, HYBRID VEHICLE POTENTIAL ASSESSMENT. VOLUME 6: COST ANALYSIS
K. S. Hardy 30 Sep. 1979 106 p
(Contract EM-78-I-01-4209)
(CONS-4209-T1-Vol-6) Avail: NTIS HC A06/MF A01

The economic feasibility of a variety of hybrid vehicles with respect to conventional vehicles specifically designed for the same duty cycle defined by the mission analysis was determined. Several different hybrid configurations including parallel, parallel-flywheel, and series vehicles were evaluated. The ramifications of incorporating examples of advanced batteries, these being the advanced lead acid, nickal zinc, and sodium sulfur were also investigated. Vehicles were specifically designed with these batteries and for the driving cycles specified by the mission. It was concluded that: in the event that gasoline prices reach $2.50 to $3.00/gal, hybrid vehicles in many applications will become economically competitive with conventional vehicles without subsidization; in some commercial applications hybrid vehicles could be economically competitive, when the gasoline price ranges from $1.20 to $1.50/gal.
DOE

N80-31275# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ELECTRIC AND HYBRID VEHICLE SYSTEM RESEARCH AND DEVELOPMENT PROJECT, HYBRID VEHICLE POTENTIAL ASSESSMENT. VOLUME 8: SCENARIO GENERATION
K. O. Leschly 30 Sep. 1979 43 p refs
(Contract EM-78-I-01-4209)
(CONS-4209-T1-Vol-8) Avail: NTIS HC A03/MF A01

Scenarios are described which have been generated to develop of consistent and credible forecasts required to estimate the potential impact of hybrid vehicles on future petroleum consumption in the USA, given a set of specific electric, hybrid and conventional vehicle designs. The four major areas of concern are population and vehicle fleet size, travel patterns and vehicle fleet mix, conventional vehicle technology (Otto baseline), battery technology, and prices. The forecasts were generated to reflect two baseline scenarios, a Petroleum Conservation Scenario and an Energy Conservation Scenario. The primary assumption in scenario A is higher gasoline prices than in scenario B. This should result in less travel per car and an increased demand for smaller and more fuel efficient cars. In scenario B the primary assumption is higher prices on cars (new as well as used) than in scenario A. This should lead to less cars and a shift to other modes of transportation.
DOE

N80-31276# Societe Nationale Industrielle Aerospatiale, Paris (France).
RECENT DEVELOPMENTS IN AEROSPACE TECHNOLOGY
J. Balazard 12 Nov. 1979 29 p
(SNIAS-792-502-101) Avail: NTIS HC A03/MF A01

A rundown of aerospace research and development activities is presented. Advances in supercritical wing technology and flow field modeling around helicopters are highlighted. Materials studies cover a titanium forming process, nonmetallic helicopter blade performance, and composite materials used in aircraft (A300 B) structures. Work on missile propulsion systems is mentioned. Recent contributions to aerospace equipment and systems design are cited. Optimization of aerospace-related manufacturing techniques is also discussed.
Author (ESA)

N80-31277# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
NONCONTACTING SUSPENSION AND PROPULSION FOR GROUND TRANSPORTATION Final Report
D. N. Wormley, H. H. Richardson, J. K. Hedrick, D. A. Limbert, and D. Mercaldi Dec. 1979 461 p refs
(Contract DOT-OS-60135)
(PB80-176274; DOT/RSPA/DPB-50-79/34) Avail: NTIS HC A20/MF A01 CSCL 13F

The technological base available for evaluation of noncontacting vehicle suspension and propulsion systems in urban and intercity transport system was assessed. Analytical and experimental performance data for two specific systems - attractive,

ferromagnetic suspension systems and air cushion suspension systems were developed. GRA

N80-31278# Wisconsin Univ. - Madison. Engineering Experiment Station.
FLYWHEEL ENERGY MANAGEMENT SYSTEMS FOR IMPROVING THE FUEL ECONOMY OF MOTOR VEHICLES
N. H. Beachley and A. A. Frank Aug. 1979 195 p refs
(Contract DOT-OS-60177)
(PB80-175300; DOT/RSPA/DPB-50-79/1) Avail: NTIS HC A09/MF A01 CSCL 13F

The experimental flywheel vehicle has demonstrated 32 mpg over the EPA-CVS Federal Urban Driving Cycle at an inertia weight of 2750 lb. Calculations based on experimental engine data indicate that federally mandated emissions levels could be achieved with little degradation in fuel economy. The computer simulation programs developed have been verified by experiment. GRA

N80-31279# General Accounting Office, Washington, D. C. Energy and Minerals Div.
INDUSTRIAL WASTES: AN UNEXPLORED SOURCE OF VALUABLE MINERALS
15 May 1980 83 p
(PB80-180250; EMD-80-45) Avail: NTIS HC A05/MF A01 CSCL 11F

The need for minerals recovery from industrial wastes is addressed. It is reported that industrial wastes often contain valuable metals, and often dispose of in ways that preclude the future recovery of mineral values. Although Congress passed the Resources Conservation and Recovery Act of 1976 to, among other objectives, improve the recovery of usable meterials from wastes, the Executive Branch has done little to enhance mineral recovery, especially from industrial wastes. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N80-31280 New Mexico Univ., Albuquerque.
A PHOTOMETRIC INVESTIGATION OF POSSIBLE BINARY OCCURRENCE IN THE CENTRAL STARS OF SEVENTEEN PLANETARY NEBULAE Ph.D. Thesis
Jack Donald Drummond 1980 127 p
Avail: Univ. Microfilms Order No. 8019219

All known and suspected visual, spectroscopic, and spectrum binaries, as well as all reported variable central stars, are presented in a series of tables. A photoelectric study was conducted in order to determine the status of short period variability of the central regions of seventeen planetary nebulae. Only the stellar appearing planetary nebula M1-2 was found to be variable. Its short period suggests that it may be only the second eclipsing binary found among central stars to date. A method of concentric apertures was developed to determine the amount of light contributed by the central star vis-a-vis the nebula through a given aperture and filter. The procedure enabled UBV magnitudes and colors of central stars to be measured including some in the sample of seventeen for which no previous values were published. Mean nebular UBV magnitudes, surface brightnesses, and color indices were also found with the technique. Various UBV two parameter were constructed, revealing possible nebular/stellar sequences; a star-plus-nebula two color diagram identifies three spectral classes of central stars, and two suspected binaries in the seventeen studied. Dissert. Abstr.

N80-31281 California Univ., San Diego, La Jolla.
OBSERVATIONS AND INTERPRETATION OF THE PERMITTED EMISSION LINE SPECTRA OF QUASI-STELLAR OBJECTS Ph.D. Thesis
Richard Charles Puetter 1980 188 p
Avail: Univ. Microfilms Order No. 8018796

Combined optical and infrared spectrophotometry of the emission line spectra of 14 QSOs are presented. A formalism is described for the solution of the frequency-integrated radiative transfer equation and the atomic steady state equation appropriate to an externally irradiated, semi-infinite medium. Asymptotic forms for scaling forms for scaling law solutions to the radiative transfer equation are developed. Escape probabilities appropriate to the above scaling law solutions are discussed for subordinate lines, strongly interlocked resonance lines, weakly interlocked resonance lines, and the bound free continua. The formation of the hydrogen Lyman alpha Balmer, and Paschen lines and the Balmer continuum in highly idealized QSO broad emission line clouds (ELCs) of constant temperature and density, irradiated by an external source of power law spectral form was calculated. The permitted emission line region that emerges is of many dense, hot, photoionized condensations that are optically thick in the resonance lines of all abundant atomic species and the Balmer lines of hydrogen, and which cover a large fraction of the sky as seen from the central object. Dissert. Abstr.

N80-31282 Massachusetts Univ., Amherst.
VERY LONG BASELINE INTERFEROMETRY OBSERVATIONS OF THE MASERS TOWARD ORION A Ph.D. Thesis
Stanley Severin Hansen 1980 217 p
Avail: Univ. Microfilms Order No. 8019484

Based on velocity, and position, the water vapor masers in Orion may be divided into five classes, four of which are associated with stages of star formulation. The fifth class may be associated with an evolved star. The masers of the fifth class have velocities from -7 to -3 km and from + 15 to 18 gm. These masers are large (10 to 60 a.u.) and less variable than the other H20 masers and occur in a single cluster 1000 a.u. in diameter. The OH masers with velocities similar to the fifth class of H20 masers are less variable, less polarized, and larger than the other OH masers. All the SiO masers have the same velocities as the H20 masers of the fifth class and at the same position. This evidence strongly suggests that all these masers exist in expanding shells of gas about a single object. VLBI observations at 1665 MHz detected three OH masers with apparent diameters of 10 30 a.u. The two strongest of these were spatially coincident, circularly polarized in opposite senses, and of equal amplitude, suggesting that they may be a Zeeman pair. The velocity separation requires a 3 milligauss magnetic field.
Dissert. Abstr.

N80-31283*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VARIABLE X-RAY SPECTRA OF BL LAC OBJECTS: HEAO-1 OBSERVATIONS OF PKS 0548-322 AND 2A 1219+305
D. M. Worrall (California Univ., San Diego), E. A. Boldt, S. S. Holt, R. F. Mushotzky, and P. J. Serlemitsos May 1980 21 p refs Submitted for publication
(NASA-TM-80700) Avail: NTIS HC A02/MF A01 CSCL 03A

X-ray spectra for the BL Lac objects PKS 0548-322 and 2A 1219+305 measured with the HEAO-1 A2 detectors during pointing maneuvers on September 30, 1978 and May 31, 1978 respectively are presented. Both fit single power law components with low energy absorption. For 2A 1219+305, a thermal bremsstrahlung form gives an unacceptable fit. From a comparison with other statistically poorer observations taken at 6 month intervals while the satellite was in its normal scanning mode, it is found that the sources exhibit spectral variability. A summary of measurements of the 5 BL Lac objects detected with the A2 experiment is presented and it is concluded that X-ray spectral changes in this class of source are common. Their general X-ray spectral characteristics distinguish BL Lac objects from other classes of X-ray emitting active galactic nuclei. Analysis of their total spectra indicates that most of the energy is emitted in the 5 to 100 eV band. M.G.

N80-31284*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
X-RAY ASTRONOMICAL SPECTROSCOPY
S. S. Holt Jun. 1980 19 p refs Submitted for publication (NASA-TM-80737) Avail: NTIS HC A02/MF A01 CSCL 03A

The current status of the X-ray spectroscopy of celestial X-ray sources, ranging from nearby stars to distant quasars, is reviewed. Particular emphasis is placed on the role of such spectroscopy as a useful and unique tool in the elucidation of the physical parameters of the sources. The spectroscopic analysis of degenerate and nondegenerate stellar systems, galactic clusters and active galactic nuclei, and supernova remnants is discussed. M.G.

N80-31285*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
QUASI-SIMULTANEOUS OBSERVATIONS OF THE BL LaC OBJECT MK 501 IN X-RAY, UV, VISIBLE, IR AND RADIO FREQUENCIES
D. M. Kondo, D. M. Worrall, R. F. Mushotzky, R. L. Hackney (Univ. of Western Kentucky), K. H. Hackney (Univ. of Western Kentucky), J. B. Oke (Palomar Observatory), H. Yee (Palomar Observatory), G. Neugebauer (Palomar Observatory), K. Matthews (Palomar Observatory), and P. A. Feldman (NRC of Canada, Ottawa) Jul. 1980 32 p refs Submitted for publication (NASA-TM-81985) Avail: NTIS HC A03/MF A01 CSCL 03A

Quasi-simultaneous observations of the BL Lacertae (Lac) objects MK 501 were performed for the first time at X-ray, ultraviolet, visible, infrared, and radio frequencies. The observed spectral slope from the X-ray to UV regions is positive and continuous, but that from the mid UV to visible light region becomes gradually flat and possibly turns down toward lower frequencies; the optical radio emission can not be accounted for by a single power law. Several theoretical models were considered for the emission mechanism. A quantitative comparison was performed with the synchrotron-self-Compton model; the total spectrum is found consistent with this model. The spectrum from visible light to X-ray is consistent with synchrotron radiation or with inverse-Compton scattering by a hot thermal cloud of electrons. The continuity of the spectral slope from X-ray to UV implied by the current data suggests that the previous estimates of the total luminosity of this BL Lac object is underestimated by a factor of about three or four. T.M.

N80-31286# Engins Matra, Velizy (France). Instrumentation Dept.
HIPPARCOS PAYLOAD STUDY, VOLUMES 1 AND 2 Final Report
14 Jan. 1980 279 p
(Contract ESTEC-3967/79-NL-MS)
(Rept-60/890; ESA-CR(P)-1318) Avail: NTIS HC A13/MF A01

A feasibility study was made which includes the mirror manufacturing process, relay optics, and star mapper grid for the three mirror telescope. The stiffness and strength requirements, and materials selection were studied, and a dynamic structural analysis performed. Payload thermal control was reviewed in terms of mirror distortion. Detection and electronics subsystems were reviewed and a data flow assessment made for data handling. Reliability predictions were made for the payload electronics. A technological development program is presented to answer uncertainties about mirror fabrication and assembly, radiation effects, and wavefront error verification. Author (ESA)

N80-31287# European Space Research and Technology Center, Noordwijk (Netherlands).
HIPPARCOS. SPACECRAFT DESIGN AND DEVELOPMENT
5 Dec. 1979 322 p
(ESA-PF-616) Avail: NTIS HC A14/MF A01

A mission study was performed including the scientific objectives, principles of observation, and a theoretical analysis of system accuracy. The payload was not included in the study. Orbital parameters, environmental conditions, thermal control, power supplies, and reliability were examined. Data handling, ground operations including computer software were analyzed, and a development plan was proposed. Author (ESA)

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N80-31288 Pennsylvania Univ., Philadelphia.
ORBITAL DECAY AND ACCRETION FOR PLANETARY OR BINARY SYSTEMS WITHIN A PLANETARY NEBULA Ph.D. Thesis
Kyu Hong Choi 1980 120 p
Avail: Univ. Microfilms Order No. 8018533

The problem of the survival of a planet and low mass secondary orbiting a primary star that becomes a planetary nebula is studied. The values of the mass of the primary used are 1.0, 1.5, and 2.0 solar mass. The values for the planet's mass are 0.001 and 0.01 solar mass. The mass of the secondary is 0.1 solar mass. The evolution of the orbital elements and mass of the secondary due to accretion and drag forces in the common envelope are presented. The possible application of the results to V471 Tau, UU Sge, WZ Sge, and Sun-Jupiter system are discussed. Dissert. Abstr.

N80-31289*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
TORQUES ON A NEARLY RIGID BODY IN A RELATIVISTIC GRAVITATIONAL FIELD
Alessandro Caporali Aug. 1980 25 p refs
(NASA-TM-78295) Avail: NTIS HC A02/MF A01 CSCL 03B

The effect of post-Newtonian potentials on the rotation of a nearly rigid body is shown to consist of a precession and a torque. The frequency of the precession can be exactly represented by means of suitable differential operators. The relativistic torques in the quadrupole approximation depend on the instantaneous orientation of the principal axes of one body with respect to the position like the classical torque and velocity of the other. For a relatively low mass body, such as a gyroscope, these velocity-dependent torques have no observable consequences. Author

N80-31290*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md. Lab. for High Energy Astrophysics.
SOFT CP VIOLATION AND THE GLOBAL MATTER-ANTIMATTER SYMMETRY OF THE UNIVERSE
Goran Senjanovic (Maryland Univ., College Park) and F. W. Stecker Jun. 1980 17 p refs Submitted for publication (NASA-TM-80730) Avail: NTIS HC A02/MF A01 CSCL 03B

Scenarios for baryon production are considered within the context of SU(5) and SO(10) grand unified theories where CP violation arises spontaneously. The spontaneous CP symmetry breaking then results in a matter-antimatter domain structure in the universe. Two possible, distinct types of theories of soft CP violation are defined. In the first type the CP nonconservation originates only from the breaking of SU(2) sub L X U(1) symmetry, and in the second type, even at the unification temperature scale, CP violation can emerge as a result of symmetry breaking by the vacuum expectation values of the superheavy Higgs sector scalars. M.G.

N80-31291*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
UTILIZATION OF MULTI-BODY TRAJECTORIES IN THE SUN-EARTH-MOON SYSTEM
Robert W. Farquhar Aug. 1980 24 p refs Submitted for publication
(NASA-TM-80740) Avail: NTIS HC A02/MF A01 CSCL 03B

An overview of three uncommon trajectory concepts for space missions in the Sun-Earth-Moon System is presented. One concept uses a special class of libration-point orbits called "halo orbits." It is shown that members of this orbit family are advantageous

for monitoring the solar wind input to the Earth's magnetosphere, and could also be used to establish a continuous communications link between the Earth and the far side of the Moon. The second concept employs pretzel-like trajectories to explore the Earth's geomagnetic tail. These trajectories are formed by using the Moon to carry out a prescribed sequence of gravity-assist maneuvers. Finally, there is the 'boomerang' trajectory technique for multiple-encounter missions to comets and asteroids. In this plan, Earth-swingby maneuvers are used to retarget the original spacecraft trajectory. The boomerang method could be used to produce a triple-encounter sequence which includes flybys of comets Halley and Tempel-2 as well as the asteroid Geographos. Author

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N80-31292 *Washington Univ., Seattle.*
THERMOLUMINESCENCE STUDIES OF THE THERMAL AND RADIATION HISTORIES OF CHRONDRITIC METEORITES *Ph.D. Thesis*
Charles Lee Melcher 1980 175 p
Avail: Univ. Microfilms Order No. 8018748

The thermoluminescence properties of chondritic meteorites are investigated to understand the ways in which the stored TL reflects the thermal and radiation histories of these objects. Differences in TL levels measured in recent falls are attributed to small differences in orbital temperatures. In addition, a correlation between TL level and terrestrial age is observed in meteorites of known terrestrial age. A modification of the apparatus for measurement of thermoluminescence is described in which a microcomputer is interfaced to the existing light detection and heating control units. The computer allows photons to be counted directly and the numbers stored automatically for later manipulation. This results in more precise as well as more efficient data acquisition and reduction. Dissert. Abstr.

N80-31293 *Arizona Univ., Tucson.*
POLARIMETRY OF JUPITER AT LARGE PHASE ANGLES *Ph.D. Thesis*
Clifford Paul Stoll 1980 95 p
Avail: Univ. Microfilms Order No. 8020326

Pioneer 10 and 11 polarimetry maps of Jupiter, taken at a wide variety of phase angles, were analyzed. Data were reduced in two colors for Jupiter's South Equatorial Belt (latitude -5 to -8 degrees) and scattering models were constructed. Variations in polarization from center to limb set constraints on the vertical structure of the atmosphere. The absolute polarization near the center of the disc constrained the single scattering polarization phase matrix of the scattering particles. It was found that a two cloud model with a haze in the upper atmosphere fits the data best. The haze particles are closely approximated by conservatively scattering spheres of index of refraction 1.5 and uniformly distributed sizes between 0.16 and 0.18 microns radius. A relationship exists between the required index of refraction for the haze particles and the mean size of the particles. The upper cloud, which is thought to be made of ammonia crystals, must be at least optical depth 2, and could be semi-infinite. The polarization scattering properties of the clouds are distinctly different from the haze, indicating a compositional or size difference. The lowest cloud is more weakly constrained. Dissert. Abstr.

N80-31294*# *Rensselaer Polytechnic Inst., Troy, N. Y. School of Engineering.*
INTERPRETATION OF LASER/MULTI-SENSOR DATA FOR SHORT RANGE TERRAIN MODELING AND HAZARD DETECTION
Brian S. Messing Aug. 1980 102 p refs Prepared for JPL (Grant NsG-7369; Contract JPL-954880)
(NASA-CR-163492; RPI-TR-MP-75) Avail: NTIS HC A06/MF A01 CSCL 08B

A terrain modeling algorithm that would reconstruct the sensed ground images formed by the triangulation scheme, and classify as unsafe any terrain feature that would pose a hazard to a roving vehicle is described. This modeler greatly reduces quantization errors inherent in a laser/sensing system through the use of a thinning algorithm. Dual filters are employed to separate terrain steps from the general landscape, simplifying the analysis of terrain features. A crosspath analysis is utilized to detect and avoid obstacles that would adversely affect the roll of the vehicle. Computer simulations of the rover on various terrains examine the performance of the modeler. T.M.

N80-31295# *Scientific Translation Service, Ann Arbor, Mich.*
STUDY OF A CHEMICAL ANALYZER OF THE CONDENSABLES IN THE ATMOSPHERE OF VENUS BY ATTENUATED TOTAL IR-REFLECTION *Final Scientific Report*
J. E. Blamont, G. Israel, F. Goutail, F. Letki, and G. Souchon Apr. 1980 48 p refs Sponsored by DOE Prepared for Argonne National Lab., Ill.
(ANL-Trans-1184) Avail: NTIS HC A03/MF A01

Results of the development of a Venusian aerosol analyzer and laboratory measurements made with it are presented. The scientific method developed for the detection and analysis of aerosols in the atmosphere of Venus is described. DOE

N80-31296# *Los Alamos Scientific Lab., N. Mex. Nuclear Chemistry Group.*
SILVER ISOTOPIC ANOMALIES IN IRON METEORITES: COSMIC-RAY PRODUCTION AND OTHER POSSIBLE SOURCES
Robert C. Reedy 18 Apr. 1980 18 p refs Presented at the 11th Lunar and Planetary Sci. Conf., Houston, Tex., Mar. 1980 (Contract W-7405-eng-36)
(LA-UR-80-1199; CONF-800361-1) Avail: NTIS HC A02/MF A01

The sources of excess Ag107 observed in iron meteorites are examined with emphasis on the reactions of cosmic ray particles with palladium. The cross sections for the production of the silver isotopes from palladium by energetic cosmic ray particles are evaluated and used to calculate spallogenic production rates relative to that of Mn53 from iron. The upper limit for the production rate of excess Ag107 by galactic cosmic ray particles is 400 atoms/min/kg(Pd) which over an exposure age of 10 to the 9th years, would make only 1% of the observed excesses of Ag107. Neutron capture reactions with Pd isotopes produce mainly Ag109. Binary fission of a siderophilic superheavy element would be expected to yield more Ag109 than Ag107. An intense proton irradiation in the early solar system probably would produce a lower ratio (Pd107/Pd108) to (A126/A127) than observed in meteorites. Therefore the presence of excess Ag107 in iron meteorites with large Pd/Ag ratios very likely is due to the incorporation of 6.6 x 10 to the 6th per year Pd107 of nucleosynthetic origin in these meteorites. DOE

N80-30341*# *Jet Propulsion Lab., California Inst. of Tech., Pasadena.*
VOYAGER-JUPITER RADIO SCIENCE DATA PAPERS
G. S. Levy and G. E. Wood *In its* The Telecommun. and Data Acquisition Rept. 15 Aug. 1980 p 114-115 (For primary document see N80-30319 21-12)
Avail: NTIS HC A06/MF A01 CSCL 03B

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N80-31297*# *National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.*
SOLAR ACTIVITY PREDICTION OF SUNSPOT NUMBERS (VERIFICATION). PREDICTED SOLAR RADIO FLUX; PREDICTED GEOMAGNETIC INDICES Ap AND Kp
Samuel R. Newman Aug. 1980 45 p refs

(NASA-TM-81139; JSC-16782; IN-80-FM-041) Avail: NTIS HC A03/MF A01 CSCL 03B

Efforts to further verify a previously reported technique for predicting monthly sunspot numbers over a period of years (1979 to 1989) involved the application of the technique over the period for the maximum epoch of solar cycle 19. Results obtained are presented. Methods and results for predicting solar flux (F10.7 cm) based on flux/sunspot number models, ascent and descent, and geomagnetic activity indices as a function of sunspot number and solar cycle phase classes are included.
A.R.H.

N80-31298*# Denver Univ., Colo. Dept. of Physics.
NEW ATLAS OF IR SOLAR SPECTRA
A. Goldman, R. D. Blatherwick, F. H. Murcray, J. W. VanAllen, C. M. Bradford, G. R. Cook, and D. G. Murcray Jun. 1980 142 p refs
(Grants NsG-1432; NSF ATM-76-83908)
(NASA-CR-163499) Avail: NTIS HC A07/MF A01 CSCL 03B

Over 4500 absorption lines have been marked on the spectra and the corresponding line positions tabulated. The associated absorbing telluric or solar species for more than 90% of these lines have been identified and only a fraction of the unidentified lines have peak absorptions greater than a few percent. The high resolution and the low Sun spectra greatly enhance the sensitivity limits for identification of trace constituents. T.M.

N80-31299# Los Alamos Scientific Lab., N. Mex.
SOLAR WIND FLOWS ASSOCIATED WITH HOT HEAVY IONS
Edward Eugene Fennimore May 1980 58 p refs
(Contract W-7405-eng-36)
(LA-8344-T) Avail: NTIS HC A04/MF A01

Heavy ion spectra from three different periods throughout the solar cycle were analyzed. The spectra indicating hot coronal conditions occur in roughly 1/7th of all measurements and almost exclusively in postshock flows (PSFs), nonshock related helium abundance enhancements (HAEs), or noncompressive density enhancements (NCDEs). The PSFs and HAEs are both probably interplanetary manifestations of solar flares. The observation of several flare related HAEs which were not preceded by an interplanetary shock suggests that the flare heated plasma can evolve into the solar wind without producing a noticeable shock at 1 AU. The NCDEs with hot heavy ions differ from the PSFs and HAEs in several ways implying that they evolve from events or places with lower temperatures and less energy than those associated with the flares, but with higher temperatures and densities than the quiet corona. Active regions, coronal mass ejections, and equatorial streamers are possible sources for the NCDEs with spectra indicating hot coronal conditions. DOE

N80-31300# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 426, FEBRUARY 1980. SUPPLEMENT: EXPLANATION OF DATA REPORTS
Feb. 1980 92 p refs
(PB80-186133; SGD-426-Suppl; NOAA-80040905-Suppl) Avail: NTIS HC A05/MF A01 CSCL 03B

The supplement contains the description and explanation of the data in the monthly publication, Solar-Geophysical Data, compiled by the National Geophysical and Solar-Terrestrial Data Center in Boulder, Colorado. Solar-Geophysical Data is intended to keep research workers informed on a timely schedule of the major events of solar activity and the associated interplanetary, ionospheric, radio propagation, and other geophysical effects.
GRA

N80-31301# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 426, FEBRUARY 1980. PART 1: PROMPT REPORTS Data Report, Dec. 1979 - Jan. 1980
Helen E. Coffey, ed. Feb. 1980 180 p 2 Vol.
(PB80-186141; SGD-426-Pt-1; NOAA-80040903-Pt-1) Avail: NTIS HC A09/MF A01 CSCL 03B

In addition to an index for 1979-1980, this prompt report provides data for January 1980 on: alert periods, daily solar indices, solar flares, solar radio emission, spacecraft observations, solar wind measurements, inferred interplanetary mangetic field polarities, mean solar magnetic field, coronal holes, and the Boulder Geomagnetic Substorm Log. It also provides data for December 1979 on: daily solar activity center, sudden ionospheric disturbances, spacecraft observations, solar radio emission, cosmic rays, geomagnetic indices, and radio propagation indices. This issue also has a section on late data: solar wind measurements December 1979, solar radio emission November and December 1979, solar X-ray radiation October 1979, and cosmic rays October, November 1979. GRA

N80-31302# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 426, FEBRUARY 1980. PART 2: COMPREHENSIVE REPORTS Data Report, Aug. 1979
Helen E. Coffey, ed. Feb. 1980 50 p 2 Vol.
(PB80-186158; SGD-426-Pt-2; NOAA-80040904-Pt-2) Avail: NTIS HC A03/MF A01 CSCL 03B

In addition to an index for 1979-1980, this issue of comprehensive reports provides data for August 1979 on: solar radio emission, energetic solar particles and plasma, and solar X-ray radiation. Solar Flare data are now eleven months delayed from date of observation, rather than the usual six months. A delay in the final listing of solar flare data also delays the Daily Flare Index, the Regional Flare Index and the Abbreviated Calendar Record. The miscellaneous data includes the energetic solar particles July 1979, active regions March 30-July 17, 1979, and synoptic solar maps March 30-July 17, 1979. GRA

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N80-31303 Pennsylvania Univ., Philadelphia.
THE RELATION BETWEEN THE GALACTIC COMPACT RADIO SOURCES AND THE EXTRAGALACTIC COMPACT RADIO SOURCES Ph.D. Thesis
Bernard Jay Geldzahler 1980 133 p
Avail: Univ. Microfilms Order No. 8018546

Maps resulting from high resolution, high sensitivity observations are presented for the quasars 3C138 and 3C286. For the first time, the structure of 3C138 over angular scales between 0.010 and 0.45 is reported. Strong evidence in favor of oppositely directed dual beam models of energy transport in extragalactic radio sources is provided by a newly discovered low surface brightness feature in 3C286 which is interpreted as the first detection of the counterjet proposed in such models. Six Galactic or suspected Galactic compact radio sources were also observed. Cygnus X-3,1909 + 048(=SS433), CL4, G127.11 + 0.54, G74.87 + 1.22, and the compact radio source at the Galactic center. It is demonstrated that the structures and physical properties of the Galactic and extragalactic compact radio sources are similar and that the Galactic objects lie on the extreme low luminosity end of an apparent continuum of luminosities. The nature of the radiation mechanism at the site of the energy generation is discussed. Dissert. Abstr.

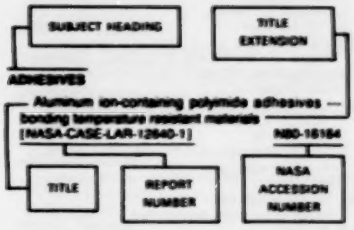
99 GENERAL

N80-31304# Office of Naval Research, London (England).
EUROPEAN SCIENTIFIC NOTES. VOLUME 34, NO. 6
Richard S. Hughes, ed. and Don J. Peters, ed. 30 Jun. 1980 54 p
(AD-A086806; ESN-34-6) Avail: NTIS HC A04/MF A01 CSCL 05/2

GENERAL **Cat. 99** **2937**

This monthly publication presents brief articles concerning recent developments in European scientific research. It is hoped that these articles (which do not constitute part of the scientific literature) may prove of value to American scientists by calling attention to current developments and to institutions and individuals engaged in these scientific efforts. The articles are written primarily by members of the staff of ONRL and occasionally articles are prepared by, or in cooperation with, members of the scientific staffs of the United States Air Force's European Office of Aerospace Research and Development and the United States Army Research and Standardization Group. Articles are also contributed by visiting Stateside scientists.GRA

Typical Subject Index Listing



The subject heading is the key to the subject content of the document. Titles, report numbers, and accession numbers of pertinent documents are provided under each subject heading. When the title is insufficiently descriptive of the document content, a title extension has been added, separated from the title by three hyphens. The report number helps to indicate the type of document cited (e.g., NASA report, NASA translation, NASA contractor report). The NASA accession number is the number by which the document abstracts are arranged in this journal and by which the document is sold or requested. The titles, with title extensions if present, are arranged under each subject heading in ascending accession number order. The subject headings have been selected from the latest revision of the *NASA Thesaurus* (NASA SP-7050).

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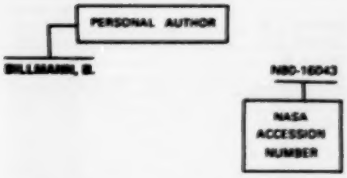

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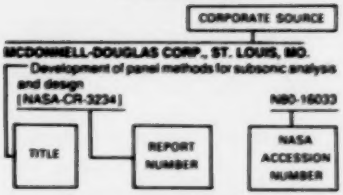

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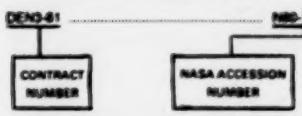

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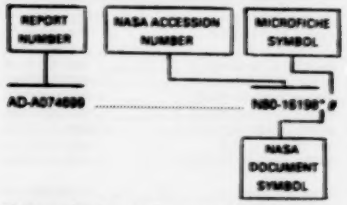

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AFOSR-80-0441TR ..... N80-30728 #
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AFOSR-80-0462TR ..... N80-31243 #
AFOSR-80-0465TR ..... N80-30459 #
AFOSR-80-0465TR ..... N80-31177 #
AFOSR-80-0467TR ..... N80-30729 #
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AFOSR-80-0469TR ..... N80-30519 #
AFOSR-80-0472TR ..... N80-30892 #
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AFOSR-80-0475TR ..... N80-30518 #
AFOSR-80-0498TR ..... N80-31105 #
AFOSR-80-0499TR ..... N80-30693 #
AFOSR-80-0500TR ..... N80-31106 #
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AFOSR-80-0502TR ..... N80-31210 #
AFOSR-80-0504TR ..... N80-30650 #
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AFOSR-80-0509TR ..... N80-30697 #
AFOSR-80-0514TR ..... N80-31141 #
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AFOSR-80-0533TR ..... N80-30765 #
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AFOSR-80-0537TR ..... N80-30731 #
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AFOSR-80-0543TR ..... N80-30690 #
AFOSR-80-0546TR ..... N80-31060 #
AFOSR-80-0547TR ..... N80-31104 #
AFOSR-80-0551TR ..... N80-30742 #
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AFWAL-TR-80-1018 ..... N80-31249 #
AFWAL-TR-80-2015 ..... N80-30732 #
AFWAL-TR-80-2041 ..... N80-30647 #
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AFWAL-TR-80-4003 ..... N80-30312 #
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AFWAL-TR-80-4065 ..... N80-30497 #

AFWL-TR-79-136 ..... N80-30600 #
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AMFL-TR-79-4191 ..... N80-30803 #

AMMRC-TR-79-53 ..... N80-30791 #
AMMRC-TR-80-5 ..... N80-30442 #
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AR-001-745 ..... N80-30300 #
AR-001-904 ..... N80-30495 #
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ARBRL-CR-00426 ..... N80-30792 #

ARBRL-IMP-639 ..... N80-30374 #

ARBRL-MR-03021 ..... N80-30374 #
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ARLCB-TR-80010 ..... N80-30809 #

ARLCD-TR-79045 ..... N80-30539 #

ARO-13847.3-MSX ..... N80-30443 #
ARO-15840.3-A-EL ..... N80-30648 #
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ARSCD-CR-80008 ..... N80-30304 #

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BNL-27094 ..... N80-30963 #
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BRAG-TR-79-2 ..... N80-31039* #

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DOE/NASA/0031-80/6-VOL-6-PT-2 ..... N80-30890* #
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DOT/RSPA/DPB-50-80/1-VOL-1 ..... N80-30470 #
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EPA-600/2-80-049 ..... N80-30988 #
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EPA-600/7-80-017D-VOL-4 ..... N80-30313 #
EPA-600/7-80-036 ..... N80-30966 #
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EPL-80-1/ONR-80-1 ..... N80-31042 #

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ERL-0123-TR ..... N80-31196 #
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ESA-CR(P)-1300 ..... N80-31203 #
ESA-CR(P)-1301 ..... N80-30348 #
ESA-CR(P)-1302 ..... N80-30709 #
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ESA-CR(P)-1319 ..... N80-30710 #
ESA-CR(P)-1321 ..... N80-30770 #
ESA-CR(P)-1322 ..... N80-30759 #
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ESA-CR(P)-1329-VOL-2 ..... N80-31063 #
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E80-10282 ..... N80-30851* #
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FAA-RD-80-31 ..... N80-30293 #
FAA-RD-80-48 ..... N80-30299 #
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FAA-RD-80-82-1-VOL-1 ..... N80-30296 #

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